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The description of the interlocking switch and signal plant at Laughlin Junction, Pa., in our issue of Sept. 13, contained some inaccuracies to which attention has been called by Mr. F. R. Patenall, Superintendent of Signals, Baltimore & Ohio R. R. At this place the Pittsburg Junction R. R. connects with the Baltimore & Ohio R. R., and the arrangement of tracks forms a triangle, of which the latter line forms the base. Both lines are double track. There are 18 signals in this plant, 13 of which are on high posts and 5 on dwarf posts. The farthest home signal is 1,008 ft. from the tower, and there are no distant signals. The derailing switches are located 50 ft. inside their respective home signals. The home signals and derailing switches are operated by independent levers, and do not move simultaneously, as stated. The derailing switches are bolt locked by their respective home signals. Signals protecting the junction points are used for blocking purposes. The machine in the tower is a 24-lever frame, having 22 working levers, and two spare spaces, there being 8 levers for 18 signals, and 14 levers for 15 regular and 5 derailing switches, one movable point frog and 24 detector bars and locks.

The elevation of the railway tracks in Indianapolis, Ind., is being agitated by the Commercial Club of that city. Plans for the work have been prepared by City Engineer Chas. C. Brown, and will be submitted to the city councils at their next meeting. These plans provide for the elevation of the tracks from West St. to Noble St., with the necessary approaches at each end, and also the elevation of the Union station and all the freight depots and yards between Mississippi St. and Liberty St. The work is to be done by building stone retaining walls on each side of the area to be elevated and filling between them with earth. The cost of the work as planned is estimated at $2,076,400.

The new station of the New York Central R. R. at Syracuse, N. Y., is now under construction, and will have a through trainshed with station building at one side. The trainshed will be 480 ft. long and 128 ft. wide, with roof trusses 109 ft. 3 ins. span, and a cantilever roof along one side. It will cover seven tracks and three platforms, the platforms being reached by subways and stairs. The trainshed will be built by the Buffalo Bridge Co. The station building, of which Mr. Bradford L. Gilbert, of New York, is the architect, will be 122 × 94 ft., three stories high, with a tower 20 ft. square and 80 ft. high. The building will be of dark red Potsdam sandstone, rock faced and laid in random courses, with string courses, copings and trimmings of dressed stone. The roof will be of Spanish tiles. The main hall will be 90 ft. square, with women's and smoking rooms 24 ft. square adjoining, and a baggage room 57 × 50 ft. The upper floors will be used for offices. The subway to the platforms will be 10 ft. wide and 8 ft. 2 ins. high, lined with white enameled brick and roofed by Guastavino tile arches. The building will be heated by steam, and lighted by 510 incandescent lamps, while the trainshed will be lighted by 30 arc lights. About 1,200 piles will be driven for the foundations. The contractors for foundations and the station building are James Stuart & Co., of St. Louis, Mo. The work has been designed under the direction of Mr. Walter Katte, Chief Engineer of the New York Central & Hudson River R. R., and will be carried out under the supervision of Mr. Van Heusen, Assistant Engineer, and of Mr. Clair Foster, Superintendent of Construction for the Architect.

The Smith triple exhaust pipe has been in service for three months on two Baltimore & Ohio locomotives, 804 and 1,416, and we are informed that it has shown an average fuel saving of about 9.1%. The advantage appears to be due to the more gentle action of the draft, the fire not being so badly torn when the engine is working at a long cut-off.

The Adams Electric Ry. Co., of St. Louis, which has claimed to hold broad patents on the use of electric motors for street car propulsion, was defeated in its suit against the Lindell Ry., of St. Louis, the decision being handed down by Judge Hallett on Sept. 17. The judge held that the Adams patent was void for want of novelty. Its only feature of real importance was its claim for the method of suspension of the motor from the axle, and this the judge decided was not a new invention. It will be remembered that Dr. Wellington Adams, the patentee in this suit, was the principal projector and promoter of the Chicago & St. Louis 100-mile-an-hour electric railway, which was to be ready in time to carry passengers to the Columbian Exposition last year. It appears to be safe to believe that this enterprise is now permanently laid on the shelf.

The most serious railway accident of the week was the derailment of a train on the Midland Division of the Grand Trunk Ry. near Fraserville, Ont., Sept. 22. The engine struck a cow and left the track, and 13 cars were smashed. Three men were killed.

A rear collision of electric cars occurred Sept. 19 on Eighth St., Philadelphia, Pa. Both cars were running at excessive speeds in order to reach Chestnut St. to pick up people from the theatre, and the first one stopped at Spruce St. to take on a passenger. There was not time to stop the second car and the two cars telescoped. One passenger was seriously injured.

The ferry steamer "Sausalito" of the North Pacific Coast Ry., ran into the new ferry slip at Sausalito, Cal., at full speed, Sept. 20, owing to the fracture of part of the reversing gear. The slip and station were damaged to the extent of $20,000, and $5,000 will be required to repair the steamer. This is said to be the second accident of the kind with the same steamer.

The 16-in. main steam supply pipe of the Trenton Iron Co.'s works, at Trenton, N. J., burst Sept. 17, and several men were scalded.

A timber trestle tower built to support two water tanks of 50,000 gallons capacity at the Pelican sawmill, New Orleans, gave way Sept. 20, and a man engaged in painting the tanks was killed. The tower was 50 ft. high, built of timber 12 × 14 ins., and the tanks are said to have contained only 15,000 gallons of water at the time of the accident.

A cyclone caused considerable damage in Iowa and southern Minnesota Sept. 21, and at several small towns houses were blown down and persons killed.

The work of the Florida Coast Line Canal & Transportation Co., referred to in our issue of Aug. 16 last, is progressing satisfactorily, according to accounts from Lantana, Fla. Less than five miles remains to be excavated of the canal connecting Lake Worth with the natural waterway of New River. One dredge-boat has worked its way six miles south of the lake, leaving behind it an open channel of 5½ ft., and another boat is working up from the south to meet it, with ten miles of canal behind her. The two boats are now about 4½ miles apart, and it is expected that they will meet about Jan. 1, 1895. The soil being drained by this enterprise is said to be the finest muck land in the world; it is almost wholly decayed vegetable matter, black as a coal even when dried, and wonderfully well adapted for the cultivation of sugar-cane, rice, cassava, pine apples and sisal hemp. The canal and natural waterways, when completed, will make a navigable route 326 miles long, extending from St. Augustine to Biscayne Bay, along the east coast of Florida.

The Georgian Bay Aqueduct Co. has been granted a charter by the Board of Works of Toronto to lay mains for carrying electric power through the streets of Toronto. The company agrees to a maximum charge of 1 ct. per HP. hour for its current and to spend $500,000 within three years in prosecuting the work. The city can purchase the company's plant at the end of 30 years. Otherwise the charter is a perpetual one. The charter still has to be approved by the executive chamber of the city council, which has the matter under consideration. The directors of the company are Messrs. W. H. Comstock, D. Booth, G. Mallory, P. Ryan, G. S. MacDonald, John Jones, J. Ryan, P. G. Close, J. L. Hughes, J. K. Leslie, C. H. MacDonald, J. H. MacDonald, Adam Ballantyne and David Hunter.

The irrigation of a Michigan fruit orchard during the past season is reported as having given satisfactory results. Water was pumped by means of a centrifugal pump, with a capacity of 650 gallons per minute, driven by a 10-HP. threshing engine. It was distributed through a 4-in. pipe to eight acres of plums and cherries with strawberries between the tree rows and potatoes in the rows, and also to 400 peach trees heavily loaded with fruit. All the trees were young. The soil varies from sandy to clay loam. Owing to the railway strikes the plant was not put in operation until August, when the drought had been in force for some time. The peaches were then within three weeks of maturity, but were improved by the irrigation. The farm is owned by Mr. M. E. Williams, of Douglas, Mich., and the water was pumped from the Kalamazoo River.

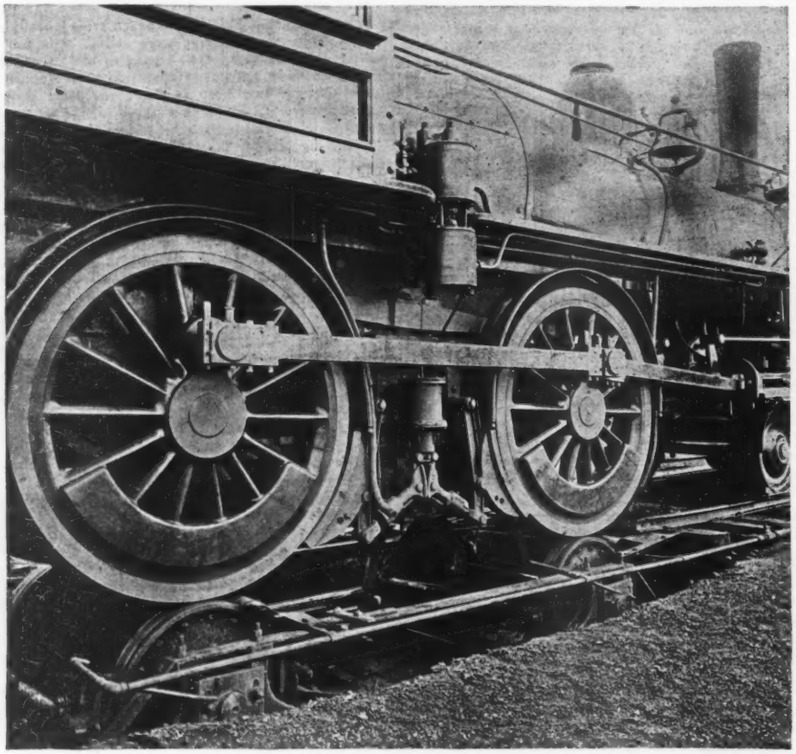
Saltness of the water supplied to the village of Le Roy, N. Y., has rendered it unfit for domestic use. The water is taken from Oatka Creek, which is affected in quality by the many salt wells and mines in the vicinity. Test wells are now being sunk under the direction of Mr. Geo. B. Bassett, of Buffalo, for a new supply from wells about a mile southwest of the village.

The method of preventing electrolysis of the water mains at Poughkeepsie, N. Y., is described as follows in a letter to this journal, under date of Sept. 14, by Mr. C. E. Fowler, Superintendent of Water-Works: The street railway company is laying a good track system, fairly well bonded. No ground plates are used and no connections are made between the track and the water mains. The dynamo is connected positive side to the trolley and negative to the rails. By advice of Mr. I. H. Farnham, M. Inst. Elec. E., of Boston, Mass., and also of L. C. Cooley, Ph. D., of Vassar College, this city, the water department is laying a pipe return wire, parallel with the water main, extending about 3,000 ft. in each direction from the railway power house. The wire is to be connected with the water main every 500 ft., and also with the negative pole of the dynamo at the power house. The wire is No. 0000 bare copper, laid about 2 ft. below the surface of the street. The connecting wires are No. 00, securely joined to an ordinary water tap screwed into the water main. The object is to provide an easy path back to the dynamo for any electricity which may leak to the mains, and thus keep the potential of the main lower than that of the surrounding earth.

Toronto has just secured a bid for street lighting by arc lamps at a figure some 30% less than it had been previously paying. The contract under which the Toronto Electric Light Co. is now lighting the streets expires in December, 1895. Under this contract the city is paying 28¾ cts. per lamp per night, or $108.59 per year. Some months ago the city engineer, Mr. E. H. Keating, was instructed to prepare plans and estimates for a plant to be owned and operated by the city. He estimated that with such a plant, street lighting would cost the city about $82 per lamp per year. Bids were asked for building a municipal plant and also for lighting the city by contract. Two bids were received on the latter basis, the lowest being submitted by the Electric Light Co. which now lights the city. This company's bid was 20½ cts. per light per night, or $74.83 per year, the contract to be for five years. The other bid was submitted by the Toronto Street Railway Co., which offered to furnish lights at 23 cts. per night, or $83.95 per year, on a five years' contract; for 22½ cts. on a ten years' contract; for 22 cts. for 20 years, and for 21 cts. for 25 years, the latter being only ½ ct. more than the bid of the Electric Light Co. on a five-year basis. For building a municipal plant a large number of bids were also received, but the low figures for lighting submitted by the other bidders seem likely to prove so attractive that the city will give up the idea of building its own plant.

SHOP TESTS OF LOCOMOTIVE EXHAUST NOZZLES.

In our issue of June 20, 1891, we published nearly in full the report of the committee appointed by the American Master Mechanics' Association to make service tests of locomotive exhaust nozzles, with the view of determining the relative areas and positions of the nozzles and stacks which gave the best results in practice. In 1893 another committee was appointed by the Association to continue the investigation of this subject, by making a series of shop tests. This committee presented its report at the convention held at Saratoga, N. Y., in June. (Eng. News, June 28.) These shop tests were made on an ordinary American type locomotive, the drivers being mounted on improvised idler wheels made of an old truck. This locomotive was provided with an exhaust nozzle so designed that the area of the opening and the distance between the tip of the nozzle and the top of the stack could be varied within certain limits. It was intended at first to use the locomotive at Purdue University for the tests, but owing to the destruction of the laboratory of that institution by fire, this could not be done and the committee was compelled to design a special truck upon which the locomotive could be mounted, as stated above. In this truck the power was absorbed by brakeshoes, the pressure on which was controlled by water, instead of air. The accompanying cut will give an idea of the general arrangement of the apparatus. The following is an abstract of the main features of the report:



APPARATUS FOR MAKING SHOP TESTS OF LOCOMOTIVES, USED BY THE MASTER MECHANICS' ASSOCIATION COMMITTEE IN INVESTIGATING EXHAUST NOZZLES.

Tests were made: (1) To ascertain the position of the exhaust nozzle, the position of the partition in the exhaust pipe and the diameter and shape of the stack that would give the best draft with the least back pressure in the cylinder. The speeds were varied from 20 to 40 miles an hour, and the cut-off from 5⅝ to 14 5-16 ins. The length of the stroke was 24 ins. (2) To ascertain the effect on the vacuum of changing the position of the choke in the smokestack. The position of the choke was varied from 6 ins. to 20 ins. above the base of the smokestack at the top of the smokebox. (3) To ascertain the effect on the vacuum of changing the length of the smokebox. Two lengths of smokebox were used, viz., 59 ins. and 38 ins. from the tube sheet.

The netting in the smokebox was taken out as a matter of convenience, and the following stacks were used in the test: Two 13-in., one 14-in., and one 16-in. straight stacks, and one 16-in. straight stack with a sliding choke.

The results showed that within the limits of these experiments the vacuum was greater when the nozzle was below the center of the boiler than when above it. The extreme limits of variation of the height of the nozzle in these tests was from 1⅝ ins. below the center of the boiler to 11 ins. above, which corresponds to a variation from 28⅝ ins. from the base of the stack, at the top of the smoke-arch, to 16 ins. from the same point.

It was found that the back-pressure line on the indicator cards was raised considerably when the partition in the exhaust pipe was at the lowest position and when the speed was low, especially for long cut-offs. This was due to the interference of one exhaust jet with the other. It is evident that for passenger engines the position of the partition is immaterial, as there was no rise of the back-pressure line on the indicator cards at high speed for any position of the partition. The variation of the position of the partition from the top of the exhaust nozzle was from 28 ins. to 15⅝ ins., and the variation of one opening of the exhaust pipe at the partition was 65% to 123% of the area of the exhaust nozzle.

After experimenting with 13, 14 and 16-in. straight stacks and a 13-in. tapered stack, it would appear that the maximum draft can be obtained under all conditions by using a tapered stack having easy approach at the bottom and a tapered part at the top, having a total angle of about 10°. It is important that the contracted portion of the stack and the exhaust nozzle be so located that the steam will strike the stack at or below the contracted portion.

With the engine tested a 14-in. straight stack gave a greater vacuum than a 13-in. and a 16-in. It was found that a variation in the position of the choke in a straight stack did not materially alter the vacuum when the steam jet struck the stack below the choke; but when the exhaust nozzle was raised and the choke lowered so that the steam jet struck the stack above the choke, the vacuum was materially reduced.

The tests showed that an increase of the length of the smokebox over and above that necessary to get in a cinder pocket in front of the cylinder saddle is unnecessary and undesirable, as the long smoke box greatly decreases the vacuum. Sufficient area of netting can be put into a smokebox which is long enough to give room for a cinder pocket in front of the cylinder saddle.

The committee which conducted these tests, composed of Messrs. Robert Quayle, Wm. Forsyth, James McNaughton, James W. Hill, W. S. Morris, and D. L. Barnes, is to make further tests during the coming year, and will probably test some of the novelties in exhaust apparatus which have been developed from time to time.

DIAGRAMS FOR PROPORTIONING WOODEN BEAMS AND POSTS.

(With inset.)

We take pleasure in presenting to our readers, on the inset sheet in this issue, two diagrams, which we believe will be found practically useful in many engineer's and architect's offices in proportioning wooden beams and posts. These very ingenious and convenient diagrams are the work of Mr. Carl S. Fogh, C. E., of Denver, Col. They were computed and plotted by him on a large scale, and were then reproduced by photo-lithography for our inset sheet. We believe, therefore, that their accuracy may be relied upon.

We have often taken occasion to commend the superiority of graphical methods of computation to arithmetical, and these diagrams are excellent examples of the rapidity and freedom from error with which computations may be made by the graphical method.

As many of our readers may wish to investigate the principles on which the diagrams are computed, to satisfy themselves that they are correct, Mr. Fogh has prepared the following explanation:

Diagram for Wooden Beams.—Let the strength of a wooden beam of rectangular section for a uniformly distributed load be expressed by:

$$\text{M in.-lbs.} = \frac{\text{W lbs.} \times \text{l ft.} \times 12}{8} = \text{S lbs. per sq. in.} \frac{bh^2}{6} \qquad (1)$$

Substituting for W its value, d k l, in which d signifies the spacing of beams, in feet, and k is the load in pounds per square foot, we have:

$$\frac{d\,k\,l^2}{8} = \frac{S\,b\,h^2}{6} \qquad (2)$$

$$\text{Whence } \frac{d\,k}{b} = \frac{S}{9}\left(\frac{h}{l}\right)^2 \qquad (3)$$

Let the deflection of a wooden beam of rectangular section for a uniformly distributed load be expressed in parts of the span by

$$\frac{12\,l\,\text{ft.}}{m} = \frac{5\,W\,l^3\,12^3}{384\,E\,T} \qquad (4)$$

in which m may be 480 and 360, W = d k l, T = $\frac{b\,h^3}{12}$, E = 1,350,000 lbs. per sq. in., then $\frac{d\,k}{b} = \frac{60{,}000}{m} = \left(\frac{h}{l}\right)^3$ (5)

By comparing formulas (3) and (5) it will be seen that they are similar in form, the left sides being identical, the right sides a function of $\frac{h}{l}$.

The diagram is made up of four parts, using the logarithms of all figures. The lower left-hand portion is a graphical representation of log d + log k = log dk. The upper left-hand portion represents log dk − log b = log $\frac{dk}{b}$. The lower right-hand portion represents log h − log l = log $\frac{h}{l}$; and, finally, the upper right-hand portion represents log $\frac{h}{l}$ + log $\frac{S}{9}\left(\frac{h}{l}\right)$ = log $\frac{S}{9}\left(\frac{h}{l}\right)^2$ which equals log $\frac{dk}{b}$, according to (3), also log $\left(\frac{h}{l}\right)$ + log $\frac{60{,}000}{m}$ $\left(\frac{h}{l}\right)^3$ = log $\frac{60{,}000}{m}\left(\frac{h}{l}\right)$, which equals log $\frac{dk}{b}$, according to (5).

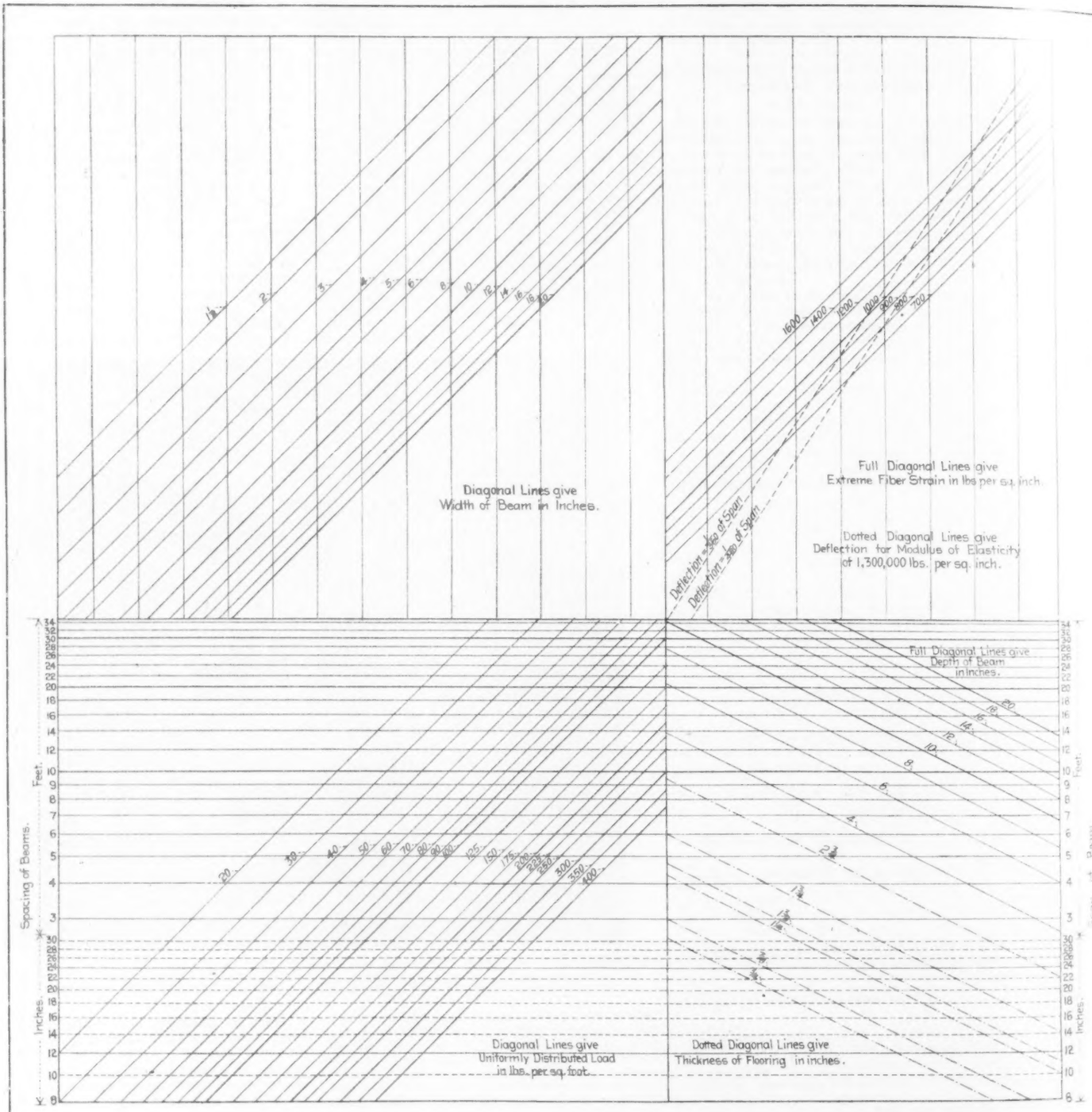


DIAGRAM FOR PROPORTIONING RECTANGULAR WOODEN BEAMS.

EXPLANATION:

From the intersection of the horizontal line corresponding to the assumed spacing and the diagonal giving the load, trace a vertical line until it intersects the diagonal giving the assumed width of beam. From this point trace a horizontal line until it intersects the diagonal giving the assumed extreme fiber strain.—If this point is above the dotted diagonal, representing the assumed limit of deflection in parts of the span, use the intersection point with the dotted diagonal.—From this point of intersection trace a vertical line down until it intersects the horizontal line corresponding to the assumed span. This point will be on or near a diagonal giving the depth of beam which will meet the assumed conditions.

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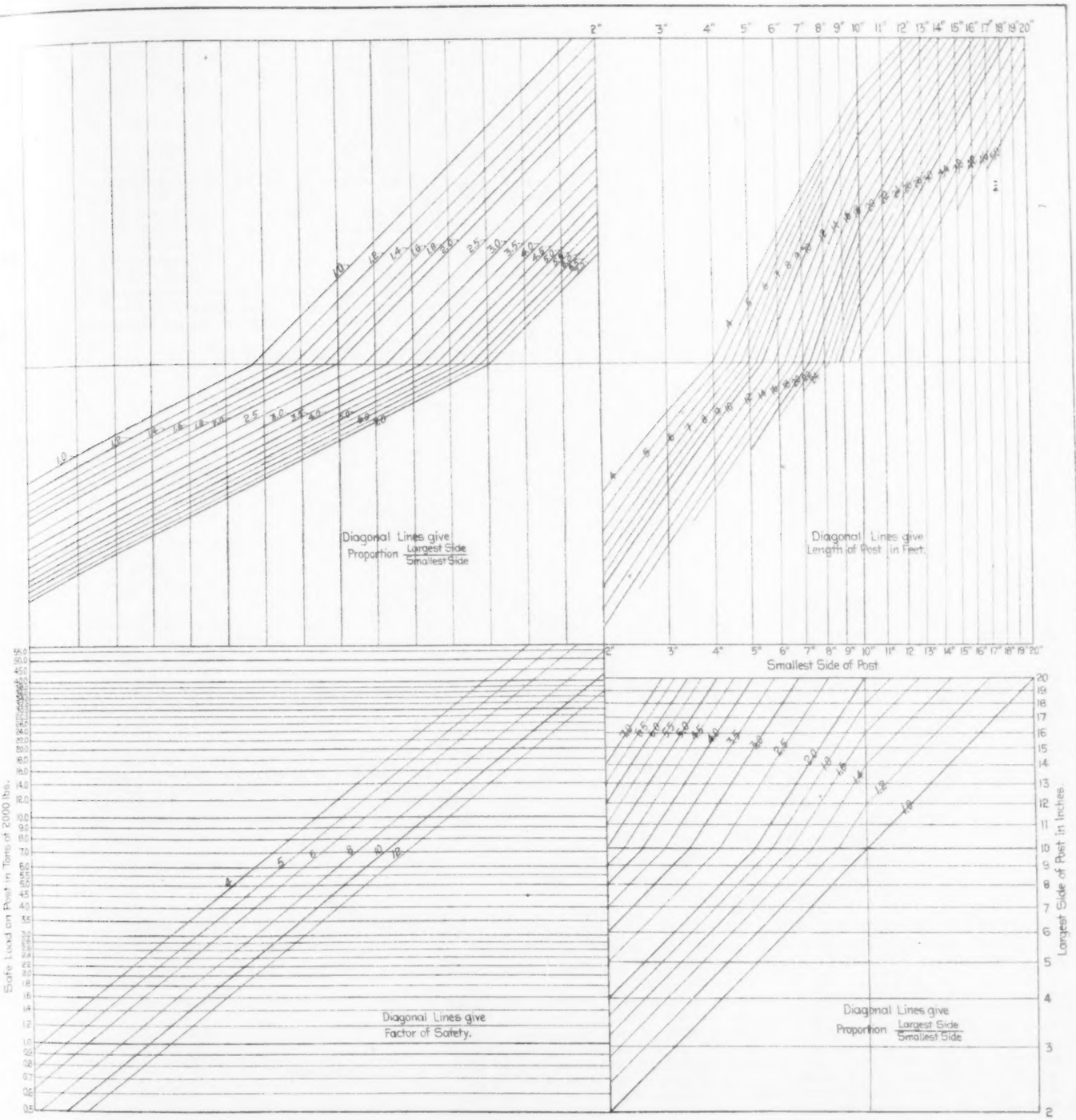
Diagonal Lines give Proportion Largest Side / Smallest Side
Diagonal Lines give Length of Post in Feet.
Smallest Side of Post
Safe Load on Post in Tons of 2000 lbs.
Diagonal Lines give Factor of Safety.
Diagonal Lines give Proportion Largest Side / Smallest Side
Largest Side of Post in Inches

DIAGRAMS
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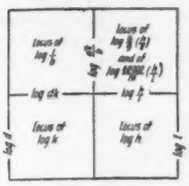
EN BEAMS AND POSTS.
mputed and Plotted by
S. Fogh, C. E., Denver, Col.

DIAGRAM FOR PROPORTIONING RECTANGULAR WOODEN POSTS.

EXPLANATION:

From the intersection of the horizontal line corresponding to the assumed load and the diagonal giving the factor of safety, trace a vertical line until it intersects the diagonal giving the assumed proportion of the largest to the smallest side of the post. Then trace a horizontal line until it intersects the diagonal giving the assumed length, which point will be on or near a vertical line giving the smallest side of the post. Then trace a vertical line until it intersects the diagonal giving the proportion of the largest to the smallest side, which point will be on or near a horizontal line giving the width of the largest side meeting the assumed conditions.

CHAS. HART & SONS, LITH., 30 VESEY ST., N. Y.



If it be required to find the dimensions of a beam for a given span of a certain kind of wood (which is taken into account by using an extreme fiber strain safe for that kind of wood), which will satisfy a given amount of uniform loading, enter the diagram at the lower left-hand portion, with the known spacing, and by following the directions given below the diagram, the lower right-hand portion will give the depth of beam required to satisfy the given condition.

If, on the other hand, the dimensions of a beam and the span are given, enter the diagram at the lower right-hand portion, and by reversing the former procedure the spacing or load per square foot will be found in the lower left-hand portion. If the transverse strength of any thickness of flooring be required, assume the width the same as the spacing and proceed as before.

Diagram for Wooden Posts.—The breaking loads of either square or rectangular posts of moderately seasoned white and common yellow pine, with flat ends firmly fixed and equally loaded, are given by Mr. Charles Shaler Smith's empirical formula ("Trautwine's Pocket-book," p. 458) in the form:

$$\text{P lbs. per sq. in.} = \frac{5{,}000}{1 + 0.004\left(\frac{l}{b}\right)^2} \qquad (1)$$

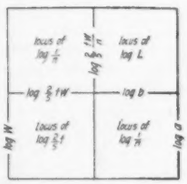
If the factor of safety be expressed by f and the sides of the cross-section by a and b, b signifying the smallest side, and, furthermore, $\frac{a}{b} = n =$ or > 1, then the total safe load in tons of 2,000 lbs. is

$$W\text{ (tons)} = \frac{ab\,P}{2{,}000\,f} = \frac{nb^2\,P}{2{,}000\,f} = \frac{5{,}000.\,nb^2}{2{,}000\,f\left(1 + 0.004\left(\frac{l}{b}\right)^2\right)} \qquad (2)$$

by transposing and giving the length in feet instead of inches,

$$\frac{2\,W\,f}{5.\,n} = \frac{b^4}{b^2 + 0.576\,L^2} \qquad (3)$$

The diagram is made up of four parts, using the logarithms for all figures; the lower left-hand portion is a graphical representation of $\log W + \log \frac{2}{5} f = \log \frac{2}{5} fW$; the upper left-hand portion represents $\log \frac{2}{5} fW - \log n = \log \frac{\frac{2}{5} fW}{n}$, which must be equal to $\log \frac{b^4}{b^2 + 0.576\,L^2}$, according to (3); the upper right-hand portion represents $\log \frac{b^4}{b^2 + 0.576\,L^2}$ as a function of log b; the lower right-hand portion represents $\log a - \log n = \log \frac{a}{n} = \log b$.



If the safe load and length of post be given, enter the diagram in the lower left-hand portion with the safe load; then the smallest side will be found in the upper right-hand portion, by following the directions given below the diagram; the lower right-hand portion gives the largest side, if n be greater than 1. If, on the other hand, the dimensions of a post are given and the safe load be required, enter the diagram at the lower right-hand portion with the greatest side, and by reversing the former procedure the lower left-hand portion will give the required safe load.

THE BUSK TUNNEL ON THE COLORADO MIDLAND R. R.

The first survey for the Busk Tunnel Ry. from Busk to Ivanhoe, Col., 2.9 miles, was made in 1888, and the Busk Tunnel Ry. Co. was organized to build the line in 1890. The principal feature of this work was the tunnel, 9,394.7 ft. long, penetrating the Continental divide of the Rocky Mountains at Hagerman Pass, in the Saguache Range, about 11.7 miles southwest of Leadville, Col. Owing to the unexpected obstacles encountered, the tunnel work proved unusually difficult, as was noted in our issues of Aug. 25, 1892, and March 30, 1893, where we described briefly the progress of the work at those dates. Through the courtesy of Mr. B. H. Bryant, Chief Engineer of the Busk Tunnel Ry. Co., we are now enabled to describe the work more in detail.

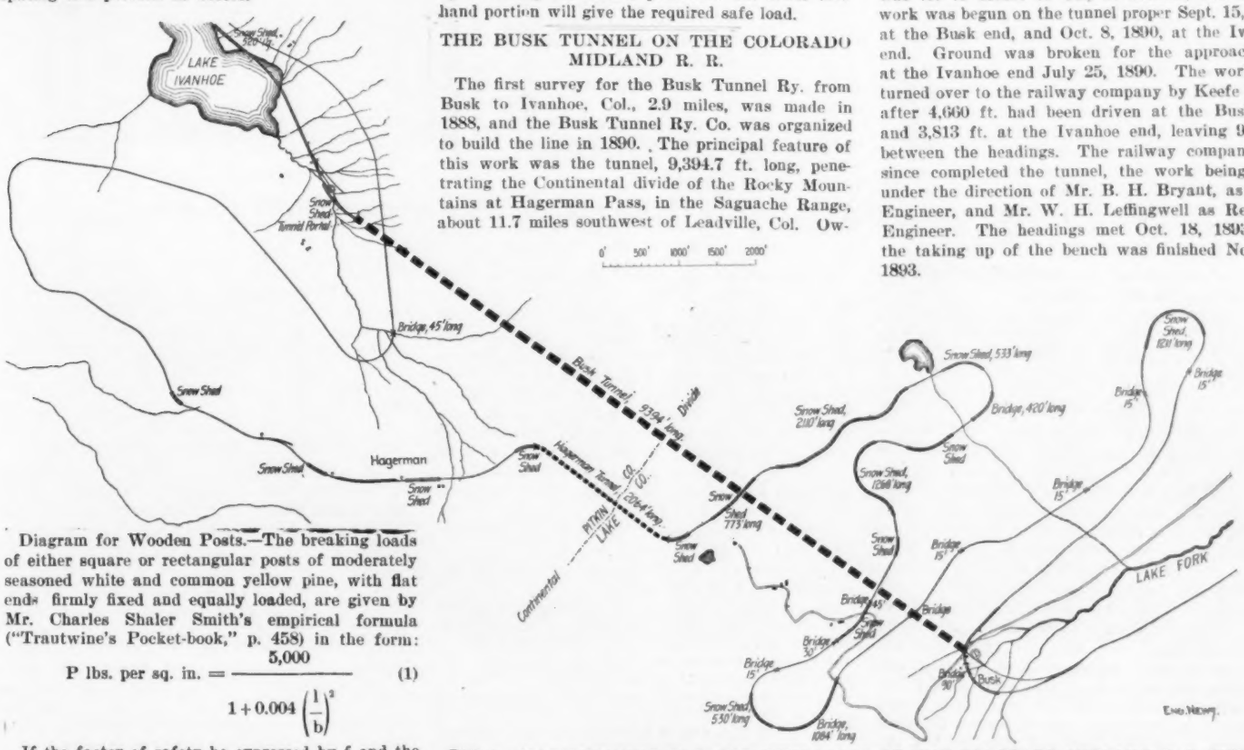


FIG. 1 MAP SHOWING OLD AND NEW LINES OF THE COLORADO MIDLAND R. R. OVER THE CONTINENTAL DIVIDE, COLORADO. B. H. Bryant, Chief Engineer. Saving in Distance by new Line, 6.93 Miles; In Elevation, 575.71 ft., and in Curvature, About 2,000°.

To enable a clear understanding of the object of the new tunnel, a brief description of the old line of the Colorado Midland R. R. across the mountains is necessary. The total length of this old line is 9.83 miles, and, beginning at Busk, it winds by a tortuous route up the eastern slope of the Saguache Range to the entrance of the Hagerman Tunnel, which is 2,060 ft. long, and thence descends the western slope by a somewhat more direct route to Ivanhoe. The accompanying map, Fig. 1, shows the route of this line and also of the new tunnel line. Besides having very heavy grades this line has always been very expensive to maintain on account of the snow and ice. In round numbers the annual cost of maintaining about 10 miles of line and of handling the business of the road over it has averaged about $70,000, or a sum equal to the interest at 7% on $1,000,000. This heavy cost of maintenance, added to the cost of hauling trains over the steep grades and the certainty that the timber trestles on the line would have to be renewed or replaced by iron structures in a few years, led Mr. J. J. Hagerman, then President of the Colorado Midland R. R., to consider the construction of a tunnel lower down the mountains. After some preliminary investigations and estimates, the engineer decided upon a tunnel route practically the same as the one on which the new tunnel has been constructed, and secured the interest of several of the Colorado Midland R. R. bondholders in its construction. Through their efforts a contract was secured from the Colorado Midland R. R. Co., by which it agreed to pay a toll of 25 cts. per ton of freight and 25 cts. per passenger carried through the tunnel if constructed. With this contract, the interest of American and English capitalists was secured and the money raised for carrying out the work.

The contract for the construction of the tunnel was let to Keefe & Co., of Helena, Mont., and work was begun on the tunnel proper Sept. 15, 1890, at the Busk end, and Oct. 8, 1890, at the Ivanhoe end. Ground was broken for the approach cut at the Ivanhoe end July 25, 1890. The work was turned over to the railway company by Keefe & Co. after 4,660 ft. had been driven at the Busk end and 3,813 ft. at the Ivanhoe end, leaving 921 ft. between the headings. The railway company has since completed the tunnel, the work being done under the direction of Mr. B. H. Bryant, as Chief Engineer, and Mr. W. H. Leffingwell as Resident Engineer. The headings met Oct. 18, 1893, and the taking up of the bench was finished Nov. 11, 1893.

Turning to the construction, a section of the tunnel is shown in Fig. 2. As will be seen, it is for a single track and is 15 ft. wide and 21 ft. high. The number of cubic yards of excavation per lineal foot of the rock section is 10.19, and when enlarged for the timbering 13.79 cu. yds. The timbering ordinarily consisted of 12 × 12-in. side sills, on which were erected 12 × 12-in. posts in sets of threes. Between the posts was a space of about 8 ins., and between each set of posts a space of 18 ins. The posts were 9 ft. high and were capped by an arch of five 12 × 12-in. segments fastened together with iron clamps. On the outside of the posts and segments was a lagging of 4 × 6 in. and 6 × 6-in. timbers, respectively. Where the weight to be supported was unusually great a double timbering was used, as shown in Fig. 2.

The heading was 7 ft. high and the full width of the tunnel, and in driving it two sets of holes were drilled. The first set of eight holes was drilled in two rows from top to bottom, the holes being about 2 ft. apart at the surface and converging towards the center of the tunnel. These holes were 12 ft. deep and the action of the blast was to blow out a V-shaped opening in the rock. The holes of the

second set were drilled at the sides, parallel to the sides of the tunnel, and the blast blew out the remaining rock into the V-shaped opening. The method of excavating the bench was nearly the same as that of excavating the heading. Working in this way the progress was as follows:

Time occupied in driving the headings	1,118 days
Average daily progress with two headings	8.4 ft.
Greatest progress in one month	337 "
Ave. daily progress for same month, 31 days	10.87 "
Greatest monthly progress, one end, 28 days	202.5 "
Average daily progress, same month	7.23 "
Greatest monthly progress on bench	218 "
Greatest daily average on bench, 28 days	7.79 "

Quite a little difficulty was experienced in driving the tunnel because of the character of the rock. This was a gray granite, and from the fact that it had been found hard and firm in the Hagerman tunnel, it was supposed that it would be the same in the new tunnel. This was not the case, however. In some places the rock was found extremely hard to drill and break and stood perfectly after exposure to the atmosphere, while in other places where it seemed at first equally as hard and firm it disintegrated on exposure, and it was found necessary to timber up to the breast of the workings to protect the men. In other places, where no disintegration was apparent, it was also found necessary to timber, because the rock was full of seams and faults, and unless it was supported, detached fragments would drop here and there, and if the key pieces fell out the entire roof of the tunnel was liable to come down. In a few places quite large cavities in the rock were encountered which were filled with liquid mud, and considerable trouble and expense were occasioned before such places could be filled and progress resumed. In one place the inrush of liquid mud was so sudden and the stream was so strong that the men barely escaped with their lives.

About 78% of the tunnel had to be timbered. The contractor's estimate for excavating and timbering the tunnel was as follows:

Excavating 9,393.66 lin. ft. at $62.50	$587,103.75
Enlargement for timbering, 32,575 cu. yds. at $2.50	81,437.50
Cost of timber	81,630.00
Cost of labor on timbering, 2,723,000 M. B. M. at $12	32,676.00
	$782,907.25

The following machinery was employed in connection with the construction of the tunnel: At the Ivanhoe end, three 100-HP. boilers, two 20 × 24-in. Ingersoll compressors, one 20 × 24-in. Norwalk compressor, a 10-HP. engine to drive the dynamo that furnished the electric current for light, a 20-HP. engine to drive a No. 6 Baker blower that was employed forcing fresh air into the tunnel through a 14-in. pipe. In the tunnel one No. 7 and one No. 9 Cameron pump and a Deane duplex pump, with 14-in. steam cylinders and 10-in. water cylinders, with 10-in. stroke, were employed pumping the water out, as the grade through the tunnel descended uniformly from the Ivanhoe end of the tunnel to the Busk end and the water followed the workings.

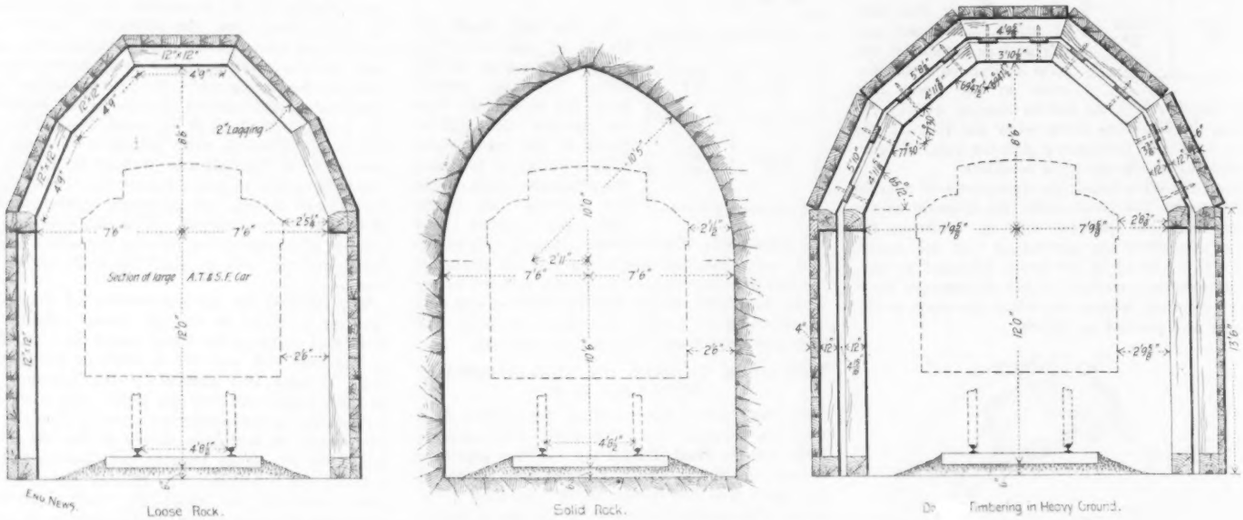


FIG. 2. TIMBER AND ROCK SECTIONS OF BUSK TUNNEL THROUGH THE CONTINENTAL DIVIDE, COLORADO.

At the Busk, or east end of the tunnel, the plant consisted of three 80-HP. boilers, two 20 × 24-in. Ingersoll compressors and 10 and 20-HP. engines driving the dynamo and blower. Four 3½-in. Ingersoll Eclipse drills were used in each heading and two on the bench, making six of these drills on each end of the tunnel. A small traction engine, constructed to run on a track of 20-in. gage, was used at each end of the tunnel to remove the material excavated. These engines were large enough to handle nine dump cars capable of holding 3 cu. yds. of material each. Coke was used on the engines for fuel and no inconvenience was experienced by the men employed in the tuunel because of the use of these locomotives on the work.

Regarding the ventilation of the tunnel, Mr. Bryant writes as follows:

Considerable anxiety was felt and expressed by parties interested in the tunnel on account of the ventilation. So far we have experienced no difficulty, as the ventilation is all that could be hoped for. The west end of the tunnel is 132 ft. higher than the east end; it acts as a chimney, and unless a strong wind is blowing from the west, the draft through the tunnel is from east to west, and as a rule the tunnel will be free from smoke from 40 minutes to an hour after a westbound train enters at Busk. After sufficient time has elapsed to clear the tunnel, it is so clear from smoke or gas that the east portal can be seen when entering the west end. We burn coke on all our engines handling trains westbound through the tunnel, but notwithstanding this precaution we sometimes have men overcome with smoke or gas. This results from the fact that when a train passes through the tunnel westbound, with the engine working hard and throwing off large quantities of smoke and gas, if men are working within a thousand feet, we will say, of the west end of the tunnel, all the smoke and gas thrown off by the engine as it is carried along by the air current has to pass the men on its way out of the tunnel; and sometimes an engine, for some reason, throws off an unusual quantity of injurious gas, and an entire gang of men will be rendered unconscious by it. This has happened three or four times since the tunnel was opened last December. We have not yet been able to discover the cause. We thought at one time the unusual volume of smoke and gas was due to carelessness on the part of the firemen in firing coal mixed with the coke, but when we examined the men they denied strenuously having used coal, and declared they had clean coke fires in the engines. I sometimes think an engine may occasionally be provided with coke that contains more impurities than usual, and perhaps the impurities in the coke cause the unusual volume of injurious gas. We are now investigating the last circumstance of this kind that occurred, and hope to arrive at an explanation of the difficulty.

The elevation of the grade at the east end of the tunnel is 10,810.72 ft. above sea level. The grade through the tunnel is 1.41%, rising from the east to the west end of the tunnel, and the elevation of the grade at the west end of the tunnel is 10,943.18 ft. above sea level. The highest point attained by the railway is a short distance west of the tunnel, and is 10,953.19 ft. The elevation of the crest of the mountain over the tunnel is 12,110 ft. The elevation of the highest point in the grade of the old Colorado Midland line is 11,528.31 ft.; the saving in elevation, therefore, by the construction of the new line is 575.11 ft.

THE HURST MULTI-CHARGE GUN.

The multi-charge gun, invented by Mr. Harris P. Hurst, is now approaching completion at the Washington Navy Yard. This gun is of 8 ins. caliber and 36 ft. long, and has a 6-ft. powder chamber 11 ins. in diameter. The rifling has one turn in 12 ft., instead of one in 16 ft., as usual. The principle of the Hurst gun lies in so dividing the charge that the projectile is first started by the explosion of a primary charge of from 10 to 15% of the total charge, and when the shot is under way, with a velocity of about 400 ft. per second, the main charge is exploded. The inventor in this way expects to decrease the strain upon the gun and reduce the danger of rupture of the walls to a minimum. A press account describes the gun and its cartridge as follows:

To accomplish this, a very peculiar cartridge is used. In the centre of the charge is a steel tube, 46 ins. long, 4 ins. inside and 6 ins. outside diameter, in the bottom of which is placed 10% of the powder charge. The projectile used is shaped somewhat like a sky-rocket; it has a cone-shaped head 15.3 in. long and 8 ins. in diameter, with a tail 30 ins. long, fitting into the steel tube. This projectile and the steel tube are then fitted in a copper cylinder about 48 ins. long and 11 ins. diameter, and between the copper shell and the inner steel tube the bulk of the firing charge is placed and held in position by a wooden base-block. In operation the primary charge is fired, driving the projectile out of the steel tube, and when it leaves this tube with a given velocity, the gases of explosion reach the rest of the charge and fire that.

At least this is the programme, and its advantages are explained by Mr. Hurst as follows: In the ordinary 8-in. gun the 250-lb. projectile has a powder charge of 125 lbs.; with the Hurst gun a powder charge of 220 lbs. can be used with the same 250-lb. projectile. The explosion of 125 lbs. of powder in an ordinary 8-in. gun produces a chamber strain of from 16 to 20 tons per sq. in.; while Mr. Hurst estimates the strain in his gun, resulting from the explosion of 220 lbs. of powder, at less

than 15 tons per sq. in., at the same time he expects a greater muzzle pressure than has ever before been approached either here or abroad.

The tests of this gun are set for next month at Indian Head, and 10 cast iron projectiles have been prepared for it. After the tests for pressure and velocity are completed, others will follow for ascertaining the proper weight of steel projectiles. Some of its advocates claim that a shot weighing 350 to 400 lbs. can be used; with the increased rifle-pitch counteracting the tendency of an 8-in. shot 4 ft. long to "tumble," the projectile is expected to have at least an initial velocity of 2,500 ft. per second, and a range of 10 miles. It is also believed that owing to the gradual velocity given the shot high explosives can be safely used in the shell, and plans are already prepared for shells carrying 49 lbs. of gun-cotton.

BRIDGE SPANS WRECKED BY A WIND STORM AT SAGINAW, MICH.

The accompanying engravings, reproduced from photographs, show the wrecks of two bridge spans at Saginaw, Mich., which were blown down during a severe storm on the evening of Sept. 9. These spans form a portion of the bridge which crosses the river in the heart of the city, and is owned by the street railway company. The 160-ft. Warren truss, the wreck of which is shown in Fig. 1, was the only span left of the original structure, which was erected by the Massillon Bridge Co. in 1863-4. It was a combination structure, the top chords and end posts being of wood, while the struts in the web members and all the tension members were of iron. The failure was due apparently to the weakness of the structure. The wind bracing and lateral bracing probably failed first, permitting a side movement of the top chords. The fixed end of the span remained in place, while the roller end was apparently lifted off the pier and fell about 10 ft. to the north. After the storm the top chords lay exactly parallel to each other on the north side of the roadway and parts of the overhead bracing were lying upon the roadway. This bracing is said to have been especially light and weak.

FIG. 1. WRECK OF WARREN TRUSS OF 160 FT. SPAN, AT SAGINAW, MICH.

FIG. 2. WRECK OF HOWE TRUSS SWING SPAN, AT SAGINAW, MICH.

The 160-ft. Howe truss swing span, shown in Fig. 2, was built only a year ago to replace a span of the old structure which was burned during the great conflagration of 1893. It was designed by Mr. Christopher L. Gates, M. Am. Soc. C. E., of Toledo, and was built by a contractor named Morris Heinemann. This span was literally turned bottom side up and dropped almost intact into the river. The cause of its failure is in doubt. It is claimed that a dredge which had broken from its moorings ran into the span during the storm, but the dredge is said to show no signs of such a collision, and the captain of a tug which was trying to hold the dredge back declares that the span turned over before the dredge reached it.

It is also stated that Mr. Gates, the designer of the span, intended to have it mounted on a steel turntable. A wooden turntable was substituted for this, however, and is described as "consisting of small Fink trusses in reversed order." From the manner in which the span fell, it is conjectured that failure of the turntable on the windward side may have caused the span to tip enough to enable the wind pressure to overturn it.

DECIMAL TIME.

M. Gerard Lavergne, in "Le Genie Civil," contributes an article on decimal time, arguing that as the universal adoption of the decimal system of weights and measures is only a question of time, the next questions to be considered are the division of the great circle and the measure of time.

As to the first, the division of the circle into 360° prevails; though for geodetic and topographical purposes the French War Department has tried the division of the quadrant into 100 instead of 90 "degrees." As to the division of time, the method employed has varied much with different periods in the world's history, as far as the division of the day into hours is concerned. Thus the Chinese and the Jews commenced the day with the setting of the sun, and the Babylonians started with the rising of the sun. The Chinese divided the day into 12 hours, some Indian nations into 60, others into 24, of which 12 hours were day and 12 night, while others again made day and night unequal divisions, and certain Brahmins divided the day into 64 hours, divided into 66 parts, each of the latter again divided into "gjambakon" or "eye-winks."

In modern times, excepting only among the Turks, who still commence the day with the setting of the sun, the day in any one place is marked by the interval of time which elapses between two consecutive returns of the same terrestrial meridian to the sun; the nominal passage of the sun over the meridian of the place marking the hour of midday. The day itself is divided into 12 hours of morning and 12 hours of evening, or, rather, "ante meridian" and "post meridian, as the divisions of the day are usually termed.

This mode of notation, designating by the same number two hours which differ between themselves by 12 units, leads to frequent ambiguities. For their own purposes astronomers have for a long time used the division of 24 hours, the morning hours having the value of the ordinary system and the notation continuing to 24 for the latter half of the day. This 24-hour system is in use in America, especially in Canada, and by the decree of Aug. 10, 1893, it is legal in Italy. From a practical and material point of view all the instruments for measuring time can be easily changed to the new 24-hour notation by simply inscribing two sets of hours for the evening divisions.

But while this passage from one system to the other is easy, the new system would yet be a sexagesimal and not a decimal system. The decimal system of day notation was attempted during the French Revolution in Article 11 of 4 Frimaire, An. II., relating to the institution of a republican calendar. This article provided that "The day, from midnight to midnight, should be divided into 10 parts, each part into 10 others, and so on for the smallest division of time desirable." But, though this calendar was applied for some years, the decimal division of the day was never used. The calendar itself could not last, for no one could practically divide into 10 equal parts 365¼ days. The division of time in a day was another thing, and M. Rey-Pailhade, of the Geographical Society of Toulouse, now contends if the proposed reform in the division of the day had been coupled with all the precautions necessary for its gradual use by the public, the new system of time would have been adopted along with the decimal system of weights and measures.

M. Rey-Pailhade would divide the day, from midnight to midnight, into 10 hours; each hour would be again divided into 10 "ces," as he called them, and each of these last divisions into 10 decimal minutes. In this way the day would be made up of 1,000 decimal minutes, instead of 1,440 of the minutes now in use. The hundredth of a day, or "ce," would be 10 decimal minutes, representing 14 m. 24 s. of present time, or almost exactly a quarter of an hour. This last, he says, is incontestably the common unit of time employed in ordinary life. The "ce," a word made up of the first two letters of the term "centijour," is made the practical base of the division of the day. In this decimal system, instead of writing March 5, 10 h. 12 m. a. m., one would write March 5, 425 md.," which simply means March 5, 4 h. 25 m. decimal.

But, asks M. Rey-Pailhade, how are we to pass from sexagesimal to decimal time? The answer is by expressing the first in hours and in fractions of hours, and then dividing by 2.4. Thus, 9 h. 25 m. equals 9.42 h., which, divided by 2.4, gives 3.93 decimal hours. Inversely, you can pass from the decimal to the ordinary system by multiplying the first by 2.4 and then transforming the hours and fractions into hours and minutes. Thus, 943 h. decimal multiplied by 2.4 equals 22.65 h., or 22 h. 39 m., or 10 h. 39 m. p. m. M. Rey-Pailhade, in his "Essai sur l'unification internationale de l'heure," gives a conversion table to simplify this somewhat awkward calculation; but he also suggests that the following table, "which can easily be learned by heart," would give a simpler relation between the old and the new notations:

Divisions of the day.	Old time, midnight.	Decimal time, midnight, deces.	cces.
1/8 day.	3 o'clock a. m.	12	5
2-8, or ¼ day.	6 " "	25	0
3/8 day.	9 " "	37	5
4-8, or ½ day.	12, or midday.	50	0
5/8 day.	3 o'clock p. m.	62	5
6-8, or ¾ day.	6 " "	75	0
7/8 day.	9 " "	87	5
8-8, or whole day.	12, or midnight.	100	0

If it is desired, for example, to convert 10 h. 25 m.

a. m. into decimal time; or, rather, to approximate within some minutes of the exact relation, we would proceed as follows: The hour given is within 5 m., equal to 10½ h. a. m.; that is, 9 h. plus 6 quarters of an hour. Nine o'clock a. m. equals 37 c. 5 dc., decimal time by the above table; remembering that one "ce" practically equals one-quarter hour, we add 6 "ces" to the 37 c. 5 dc. and have 43 c. 5 dc. as the equivalent decimal time for 10 h. 25 m. a. m. This approximation can be made more exact by remembering that one minute of ordinary time is equal to a "decice," or one-tenth of a "ce," divided by 1.44.

M. Rey-Pailhade enters into numerous other conversion calculations, which are here omitted, and has also devised watch and clock faces with concordance and decimal divisions. As to the advantages of the new system, he claims that it will render many calculations involving time much easier than at present, and he gives us as an example the calculation of the volume of oxygen absorbed during a whole day by a chemical mixture, knowing only the volume absorbed during a fraction of a day. He shows by figures that while this is a very complicated calculation, using the present time notation, it is a very simple one with the decimal system—that is, when you understand the decimal system sufficiently well to use it. He also believes that the adoption of the decimal system would much facilitate the change from local to universal time. It is probable, however, that the adoption of this decimal notation of time will be postponed for some time to come, as even the French confreres of M. Rey-Pailhade do not yet see their way clear to approve of his plans.

A NEW FORM OF DRAFT SHEET.*

To illustrate our present front end arrangements we will first consider the short front with diamond stack, where we use low exhaust tips, about 6 ins. above the bottom of the smokebox, and above this a petticoat pipe with a flange. This was placed so that the top of the lift pipe was from 2 to 4 ins. from the base of the stack. The lower end was adjusted over the exhaust nozzle to equalize the draft through the tubes; raising this pipe caused a stronger draft on the lower tubes and the back portion of the grate. Lowering gave stronger draft on the upper tubes and on the front of the grates. If the adjustment was incorrect a portion of the tubes would become stopped and the fire would burn unevenly. This lift pipe acted as a combining tube for the jet from exhaust and the gases from the tubes.

Our present extension front is an evolution from the other form, containing all the principles and features in different form. We have the diaphragm or baffle plate to regulate the draft, and the exhaust tips are raised to a point where the action of the jet will best combine with the stack opening to produce the most efficient vacuum. There is as certainly a proper proportion for these two parts as for the proportions and distances apart of the steam nozzle and combining tube of the injector to perform certain results. We consider a straight stack preferable to a taper or choke stack, for the reason that less refinement is necessary in the relation between exhaust and stack. With the taper or choke stack the escaping steam must expand at or below the choke to produce proper vacuum, while with a straight stack, variation of exhaust, height and diameter will not affect results, thus producing a considerable economy in repairs and maintenance, where one size of stack and pattern of exhaust can be utilized in varied classes of engines.

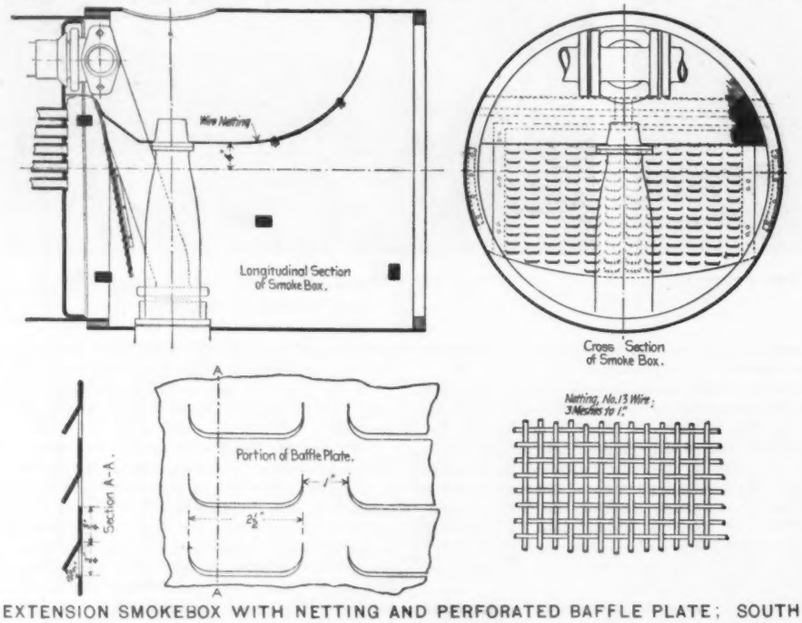
The extension of the front smokebox is to permit introducing different areas of netting, to allow free escape of smoke and gases to the stack and to act as a receptacle for sparks drawn through the tubes and unable to pass through the netting. The area of netting should be about four times the tube area. The report of the committee on Exhaust Nozzles and Steam Passages of the Master Mechanics' Association shows by shop test that a short front gives more vacuum than a long one, but we think there are conditions that must be considered before accepting this result. The test was made without netting, and we are aware that the vacuum would vary in service with thickness of fire and openings, or leakage into firebox. The size of the receptacle for sparks is dependent on the character of fuel, the mesh of netting, the service and length of run required without sparking.

It is apparent that the front of locomotive engines is defective for producing good fuel economy; for with a solid baffle plate in front of the tube for controlling and regulating draft on the tubes, it is impossible to obtain a uniform draft through all of the tubes, even though adjusted to equalize as between the upper and lower tubes, for there will be tubes nearer horizontally to the line of action of the draft which will get more pull through them than others further away. Many have recognized this fact, and have tried round and rectangular perforations in baffle plate. When these perforations are small, not to exceed ⅝ in. diameter, and not too numerous, the results may be slightly better than with a blank sheet; but with large and numerous holes the functions of the draft sheet are interfered with, and draft is concentrated upon those tubes nearest the line of draft.

It will be readily observed, that if any portion of the tubes are acted upon more than others by the vacuum formed by the escaping steam in the stack, in consequence the draft will be concentrated on the portion of grate most in line with the tubes acted upon, which results in pulling the fire from that portion of the grate. This carries away unconsumed fuel and causes a rush of cold air through the grate made bare by the lifting of the fire.

The writer has given this subject a great deal of consideration, and after much experimenting, he has designed a perforated draft plate, which has projecting lips or hoods over the openings formed in the sheet. These hoods project downwardly and rearwardly, offering a resistance to the air and gases, causing them to take a circuitous passage through the diaphragm, and at the same time preventing the escape of sparks otherwise than by the passage at the bottom of the plate, and allowing a freer escape of gases to the stack. The circuitous course of the current produces a nicely balanced effect upon the tubes and all parts of the fire, and admits of using a much lighter and milder exhaust. Thus the gases are allowed to flow through the tubes more slowly, and less coal is blown out unburned. By the difference in location the deflecting lips are made to bear varying relations to the direction of the draft from different tubes, that is to say, from the lower and more distant tubes the direction of the draft is such that it passes upward beneath the lips, and thus suffers less opposition than the draft from the upper tubes. We are enabled to use 4¼ to 4⅝-in. single nozzles, with cylinders 16 × 24 ins., and 4¾ to 4⅞ ins. for 18-in. engines, with an economy in fuel, based on same mileage and number of cars handled under similar conditions, of $300 per annum for each engine.

The cut shows this plate as applied, and the form of the perforations. Another arrangement removes the obstruction of netting for the free escape of gases and smoke to the stack, the netting being arranged to retain the sparks in the front, after being deflected under the draft plate. In this arrangement the netting is inclined from the top of the front end to within 1 in. of the bottom of the baffle plate. As before noted, the gases escape freely through the openings in the draft sheet, but the sparks cannot change their course abruptly enough to pass out of the hooded openings, and are deflected to the front in the usual manner, where they are prevented from escaping towards the stack by the projecting netting. This arrangement allows the use of largely increased nozzles and good steaming, with a considerable reduction in fuel consumption. We have not had the latter form in use sufficiently to give any accurate figures as yet. I may add that we have been enabled to run a 16-in. passenger engine, with four cars, 60 miles to a ton of coal, and an 18-in. freight engine full loaded, 45 miles per ton.



EXTENSION SMOKEBOX WITH NETTING AND PERFORATED BAFFLE PLATE; SOUTH CAROLINA & GEORGIA RY.

* From a paper by Mr. E. M. Roberts, Superintendent of Motive Power of the South Carolina & Georgia Ry.; from the Proceedings of the Southern and Southwestern Railway Club.

BUILDING OPERATIONS IN NEW YORK IN 1893.

The extent and character of a year's building operations in New York are indicated in a general way by the accompanying table, taken from the last report of the Department of Buildings, covering the year 1893, which has just been made public. The figures of cost are estimates merely, and there is nothing to show how much of this work was put under way. The different classes of buildings for which permits were asked, the disposition of the applications and the estimated cost of the buildings were as follows:

Classification.	Total.	Approved.	Amended and approved.	Disapproved.	Estimated cost.
Dwelling-houses:					
To cost over $50,000..	44	5	36	3	$1,878,500
Bet. $20,000and$50,000	131	36	89	6	3,267,250
Less than $20,000....	328	133	192	3	4,200,930
Flats—Cost over $15,000	551	144	361	46	14,244,000
Tenement-houses:					
Cost less than $15,000	52	16	24	12	637,000
Hotels and b'd'g-houses	10	2	6	2	1,239,000
Stores: Over $30,000....	51	3	46	2	4,866,000
Bet. $15,000and$20,000	24	1	19	4	472,000
Less than $15,000....	56	15	28	13	220,100
Office buildings	42	13	26	3	7,235,425
Manufactories and workshops	141	14	96	31	3,296,400
School-houses	12	1	9	2	1,495,000
Churches	13	4	7	2	5,509,000
Municipal buildings....	17	7	9	1	2,191,000
Places amusement, etc.	7	2	5	..	546,000
Stables	108	25	77	6	1,518,550
23d and 24th Wards:					
Frame dwellings	469	265	157	47	1,623,530
Other fr'me structures	228	118	88	22	359,633
Totals	2,284	804	1,275	202	$54,850,318

It will be seen that the biggest showing, both in number of buildings and in cost, about one-fourth of the whole, is made by flats, for which 551 applications were made and 46 disapproved. The total estimated cost of these flats was $14,244,000. Dwelling houses of various kinds make the next largest aggregate, and office buildings come next with a total cost of $7,235,425.

Nearly half of the total estimated cost of the projected buildings was made up by flats, dwellings, hotels and boarding houses.

Of a total of 2,284 applications 202, or a little less than 10%, were disapproved, and 1,275, or over 50%, were approved only after amendment.

The 1,299 passenger elevators in the city were

inspected on an average a little over twice each during the year, 105 inspections out of a total of 2,518 showing non-compliance with the law. In 40 cases of non-compliance the fronts of cars were unprotected, and in 40 other cases new ropes were required; 6 elevators had defective running gear, 5 had safety attachments out of order and 4 had defective cylinders.

During the year 3,275 notices to place fire escapes on buildings were issued, but doubtless some of these were duplicate notices. Mr. T. J. Brady is the Superintendent of Buildings of New York city.

THE BLACKWALL TUNNEL, ENGLAND.

The Blackwall tunnel under the Thames, in London, was described in a recent paper read before the British Association, by Mr. Maurice Fitzmaurice. The building of this tunnel was contracted for in 1891 by Messrs. Pearson & Sons for $4,355,000. The diameter of the tunnel, 27 ft. outside, is the largest of any tunnel built by the shield method; the St. Clair tunnel, of 21 ft., is the next in size. This tunnel will be 6,200 ft. long, including 1,735 ft. of open cut with retaining walls, 1,382 ft. of "cut-and-cover" work in brick and concrete, and 3,083 ft. of tunnel proper with cast iron lining. The roadway will be 16 ft. wide with two footways 3 ft. 1½ ins. wide each. The tunnel is level under the river, with approach gradients of 1 in 34 and 1 in 36. There will be four vertical shafts, two on each side of the river, 48 ft. in inside diameter and sinking from 75 to 100 ft. below ground level. These shafts will be sunk by caissons, 58 ft. in diameter, with double wrought iron walls, 5 ft. apart, and a cutting edge.

The tunnel section will be made of cast iron rings 2 ft. 6 ins. long and in 14 segments with a key piece. The circle is 27 ft. in external diameter, with metal 2 ins. thick and flanges 12 ins. deep. The shield is 19 ft. 6 ins. long and 27 ft. 8 ins. in external diameter, with the outer shell made of ⅝-in. steel plates. There are two vertical diaphragms, with the space between to be utilized as an air lock, both being provided with doors, etc. The working face is divided into four horizontal floors and 12 working chambers by horizontal and vertical plates, and a hanging iron screen in each compartment, about 6 ft. back from the cutting edge, forms a safety chamber at its back where men can stand with their heads out of water in case of a rush of water at the face, due to a "blow out" of air. The shield weighs 250 tons, and is pushed forward by 28 hydraulic jacks, having an aggregate pressure of over 3,000 tons.

A late issue of the London "Daily News" says that 700 ft. of the open approach, on the Middlesex side, has been completed, and about 750 ft. of the cut-and-cover work is done. The shield is in position at the southern edge of the river and 24 lbs. air pressure is used to keep out water. The river tunnel work, just beginning, will be pushed through material protected by a thick clay stratum for about 700 ft. But then come loose earth, shingle and sand for some distance, with only 7 ft. of stuff between the top of the tunnel and the river bed; the river is 47 ft. deep at high water. The contractors have received permission from the County Council to cover the thin spot with 10 ft. of clay. The tunnel was described and illustrated in our issue of June 16, 1892.

A DEVICE FOR INSPECTING THE INTERIOR OF PIPE SEWERS.

By Walter C. Parmley, Assistant City Engineer, Peoria, Ill.

Owing to the importance of thorough inspection of pipe sewers, the simple apparatus shown by the accompanying cut will probably be of interest and value to engineers in charge of sewer construction. It is simply a specialized form of the heliotrope. An assistant with a mirror about 8 × 12 ins. in size throws the sunlight upon the mirror, A, which reflects it into the sewer, or upon any desired point. The image thus illuminated is observed through the telescope, C, by the reflection in the small mirror, B. The two supporting posts shown are no part of the heliotrope.

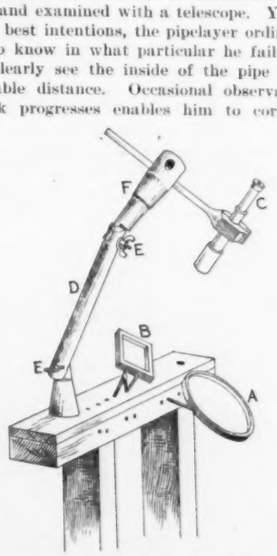
The apparatus consists of a stick of wood 2 × 3 × 20 ins. in size, with numerous ¼-in. holes bored through it in both horizontal and inclined positions. Two mirrors mounted on wooden backs, one 6 ins. in diameter and the other 2 ins. square, are hinged or swung in Y-shaped frames, the branches being No. 6 wire and the stems ¼-in. iron rods, 6 ins. long. The wooden timber is laid across the sewer in the manhole and the rods carrying the mirrors are inserted into the holes convenient for reflecting the light into the sewer. The observer takes such a position that his back is toward the section of sewer under examination. The image which he thus sees in the mirror, B, or the telescope, C, is erect and in its natural position.

The mounting of the telescope is by means of the post, D, about 2 ft. high, turning on a 1-in. pivot at the bottom. The post is jointed at right angles at EE, and clamped in position by thumb nuts. It is also pivoted at F. A ½-in. hole is bored through the top of the post, in which turns and slips the ½-in. wooden rod with clamp holding the telescope.

The post can be set up at either end, or at the middle of the 2 × 3-in. timber, and the telescope, magnifying 10 diameters, can be readily given any position and pointing.

In inspecting sewers in course of construction the heliotrope is set transversely in front of the open pipe, in a similar position to that which would be taken in the manhole.

The beneficial effect of its use upon the work performed was immediate and marked. The men realized that work which ordinarily is covered immediately from view was to be illuminated by full sunlight and examined with a telescope. Yet, even with the best intentions, the pipelayer ordinarily is unable to know in what particular he fails, as he cannot clearly see the inside of the pipe for any considerable distance. Occasional observation as the work progresses enables him to correct his



Device for Inspecting the Interior of Pipe Sewers.

failures, and thus greatly to improve the quality of his work. Even the slightest errors of grade and alinement, of fitting the pipes smoothly into each other, of raking out the cement on the inside of the joints, or even bad defects in the pipe itself, are easily detected.

In range its power is ample, as I have examined the inside of a whole block of 4-in. drain tile from one position, and the larger sizes are more easily observed.

The mirrors are all plate glass. The instrument was not designed for elegance, but entirely for use and portability; and the cost, exclusive of telescope, was less than $3. The whole equipment, including the 8 and 12-in. mirrors (which are mounted with a protecting cover over the glass), can be easily bundled up and carried upon a bicycle.

CHAMBER-MINE FIRING.

In a paper read before the Institution of Civil Engineers, by Mr. O. Guttmann, on the operations for improving the Danube River, at the "Iron Gates," reference is made to the removal of Greben Point. This spur had an almost vertical face towards the river, and chamber-mining was resorted to. A heading, 3 ft. wide by 4 ft. high, was first driven about 80 ft., and quite straight; then a chamber, 6 × 6 × 6 ft., was blasted out at right angles to it. This was charged in the usual way and the heading closed by brickwork set in cement and dry stone packing.

Into such a chamber were placed 5 tons of second-grade new dynamite, containing 45% of blasting gelatine. At first "carboazotine" was used, a compound of 74% potassium nitrate, 12% of sulphur, 8% of soot and 6% of bran, prepared by the wet process. It was a low explosive of the nature of blasting powder. In one chamber-mine, with a breast of 60 ft. and a height of 99 ft., 3,885 tons of this carboatzotine was fired, and brought down about 700,000 cu. ft. of rock. The largest blast made was in May, 1894, when 2,100,000 cu. ft. of rock were thrown down by 12 tons of second-grade dynamite. In both these cases about 80 cu. ft. of rock were removed per pound of explosive.

The formula used for charging the chamber mines was, $L = 3\ (v^3 + 5\ h)\ q$. In this L was the weight of the charge in kilograms; v, the line of least resistance in meters; h, the weight in meters of the rock above, and q was a coefficient depending on the explosive used. For carboatzotine this latter was found to vary from 0.18 to 0.23, but was usually taken as 0.22.

The height of the rock seems to be of little importance, according to the author, as the omission of the term 5 h from the calculation only made a difference of 100 kilograms in a charge of 4,000 kilograms. Thus the formula practically resolves itself into the cube of the line of least resistance multiplied by a coefficient. This is almost identical with the formula obtained by considering the explosive to act in spherical waves in an unlimited homogeneous solid, namely, $L = 4.1888\ r^3\ c$. This is the formula used in the harbor works at Fiume, where the ratio of height to line of least resistance was kept constant at 3 : 2. Both these formulas, says Mr. Guttmann, give the quantity of charge too high, since they can only be true in a perfectly confined space—a condition which never occurs in practice, for there is always at least one free surface—and consequently the formula based on the formation of a conical crater must be more accurate. This formula is:

$$L = k\ (w + r)^3,$$

where L is the weight of the charge in kilograms, w is the longest line of resistance at right angles to and towards the free face in meters, and r is the radius of the crater in meters, which should not be more than 3-2 w. As an additional quantity of charge is desirable to insure success, the spherical-wave formula may be used, though at some extra expense.

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

Liability of County for Defective Bridges.

A county is not liable in an action for damages caused by the neglect of its officers to keep in repair a bridge upon a public highway within its limits, unless such action is expressly given by statute. Notwithstanding that the statutes of this state impose upon the boards of county commissioners the duty of keeping in repair the bridges in counties having no township organizations, and provide the method and means of raising revenue for that purpose, in the absence of an express statute making such county expressly liable to an action for damages caused by a neglect of such duty, no action lies against the county by a private individual.—Bailey v. Lawrence County (Supr. Ct. of So. Dak.), 59 N. W. Rep., 219.

Validity of Municipal Contracts.

It is a general and fundamental principle of law that all persons contracting with a municipal corporation must, at their peril, inquire into the power of the corporation or of its officers to make the contract; and a contract beyond the scope of the corporate powers is void, although it be under the seal of the corporation. This principle is more strictly applied, and properly so, than in case of private corporations.—Van Antwerp v. Dell Rapids Township (Supr. Ct. of So. Dak.), 59 N. W. Rep., 209.

Negligence in Sewer Building.

Plaintiff was injured by the caving in of a sewer in which he was working, under a foreman whose principal duty was superintendence. The trench was unbraced, except by blocks of earth left for that purpose, 25 ft. apart, and there was no extraneous cause for the caving in. The negligence of defendant's foreman was for the jury to determine as a question of fact, rather than for the court as a matter of law. In such case, the question of plaintiff's negligence, though he was experienced in digging such trenches, was also for the jury.—Hennessy v. City of Boston (Supr. Jud. Ct. of Mass.), 37 N. E. Rep., 668.

Liability for Pollution of Streams by Sewer.

Where a city constructs sewers so that they empty into a stream and render unfit for use all the waters on a farm, by reason of part of the stream going underground through seams and fissures in the limestone bed of the stream, damages may be recovered by the owner of the farm.—Good v. City of Altoona (Sup. Ct. of Penn.), 29 At. Rep., 741.

DATA REGARDING ASPHALT PAVEMENTS IN VARIOUS CITIES OF THE UNITED STATES.

Compiled by Mr. H. P. Langworthy, Secretary of the Board of Public Works of Kansas City, Mo.

City.	Kinds of asphalt.	Thickness, ins. Asphalt.	Thickness, ins. Concrete.	Cost, sq. yd. $	Guarantee, yrs..	Payment.	Repairs (guarantee expired) how p'd.&cost.	Remarks.
New York	Trinidad Lake and European rock.	2 2½	6	3.00 to 3.25 3.50 to 5.00	5 15	Cash.	City funds. Not expired.	Very satisfactory. Prices include cost of grading and adjusting old curbstone. Trinidad Lake asphalt laid exclusively past 2 years, and is the best.
Chicago	Trinidad and Pitch Lake Trinidad.	2½	6	2.83 to 2.93	5; 20% pr yard reserved.	Special assessment.	City funds.	Cost on old macadam street, $1.90. In 1888 had 3.34 miles of asphalt, and to-day 16.65 miles—a continuous increase, and on the whole it is satisfactory. Specifications say, "Equal to Pitch Lake Trinidad."
Philadelphia	Trinidad Lake and Sicilian rock.	2	6 8[2]	2.75 2.50 for bitum.base.	New Sts. 3; re-pavd, 5.	Assessment bills.	City fds.Wearg surface $2 pr sq.yd. per yr, 1893.	Very satisfactory. Intersections and repaving paid for by warrant on city treasurer. Repairs $3.80 per sq. yd. per ft., including concrete and removal of old material. Trinidad Lake is best.
Brooklyn	Pitch L'k Trinidad.	2	6	2.00without foundat'n	5	Cash.	City f'ds. $1.80 pr.sq.yd.pr.yr.	Nearly all asphalt laid on cobblestone foundations with cushion of bituminous concrete. Not considered desirable for heavy traffic. Trinidad pitch lake is best.
St. Louis	Trinidad Lake.	2½[1]	6[1]	2.70	1 yr. free; 9 years, 9 cts. pr sq.yd.at first,latr 4½ cts.	Special tax bills.	City funds.Contracts, pr yr.; asphalt, $2.40 pr sq. yd; concrete, 0.87; asphalt,1.44;concrete, 0.67.	Satisfactory. Contractor has stood by maintenance; left to ordinary care would have been unsatisfactory. Less important where comes from than how handled and what mixed with it. We drop "Trinidad Lake" and open competition to any asphalt which has proven fit material.
Boston	Trinidad Lake. Sicilian rock.	2½	6	3.08	5	Cash.	City funds. No data.	Given satisfaction. Natural rock pavement no good.[10]
Baltimore	Trinidad Lake.	3	6	Blocks,2.50: sheet, 2.70.	2; can be incrsd.	Cash; 10% retained 2 yrs.	City fds.$487.50 pr mo.,20 mos. for all streets.	Satisfactory for the purposes for which they are made. Use 1½-in. binder and 1½-in. surface.
San Francisco	Bituminous rock.	2½	6	1.70 to 2.34	....	....	City fds.$487.50 pr mo.,20 mos. for all streets.	Extent of paved streets about 5,000,000 sq. ft.; average cost about 24 cts. per sq. ft. Some pavements laid over 6 years and but few repairs required.
Cincinnati	Principally Trinidad Lake.	2½	6	3.00	5	Cash.	City funds.Abt. 7cts. pr yd..pr year for 5 yrs.	Proved satisfactory; 10% of contract retained for 5 years to secure repairs. Asphalt finish 2-in. surface on ½-in. cushion.
Cleveland	Trinidad Lake.	2½[3] 2[4]	6[3] 4[3]	[2]2.95 to 3.00 [2]2.05 to 2.10	10	Cash.	City funds. No expirations.	Special reasons for low prices on latter work. $2.30 to $2.40 more nearly in proportion. Special improvement bonds are issued and sold by city.
Buffalo	Trinidad Lake, German rock, Kentucky rock.	2½	6	3.00 with curbing.	5	Warrants, 5% interest.	City funds.Abt. 5c. pr sq.yd. per year.	On whole have proved satisfactory. Pavements laid in 1884 largely resurfaced and guarantee extended to 8 yrs. Taxes for paving work payable in five annual installments. Warrants cash when taxes are available.
New Orleans	Trinidad Lake.	2½	6	3.16 to 3.50	5	Part cash, part time.	City funds No expirations.	Have proven satisfactory. City pays for street intersections; negotiating with the Barber Co. to keep streets in repair at so much per yr. on all expirations.
Washington	Bermudez, Trinidad Lake. Asphalt blocks.	..	4 6	Lake, 2.00 to 2.25 Blocks, 2.00	5	Cash.	Average annual cost: Repairs, 3c. per sq.yd.; resurf'c'g,1.50 per sq. yd.	Prices exclusive of grading. Life of asphalt and asphalt blocks undetermined; asphalt pavement on Pennsylvania Ave. lasted about 12 yrs., which should be minimum life if well laid. Life of asphalt blocks about 9 or 10 years.
Detroit	Trinidad Lake. Bermudez.	..	6	About 2.50.	....	....	.....	Excavation and curbstone extra. Bermudez appears equal, if not superior, to Trinidad.
Milwaukee	Trinidad Lake.	..	..	2.87	5	....	.....	Limited experience in asphalt pavements.
Newark	Trinidad Lake.	2½	6	Av. 2.82½	5	Cash.	No expirations.	Satisfactory so far. Asphalt ½-in. cushion coat and 2-in. covering. First asphalt laid in 1889.
Minneapolis	Trinidad Lake.	2½	6	2.75	10	In 5 installmts.	.....	Satisfactory. In future will probably pay cash. Cracks appeared in one year; cause cold weather.
Louisville	Trinidad Lake.	2½	6	3.00	5 and 10	Cash, monthly estimates.	City funds. 10c. sq.yd., per yr.	Trinidad asphalt pavements have not given satisfaction. Do not think that any of the other kinds could be much worse.
Omaha	Trinidad Lake.	2½ 3	6	2.58 to 2.68	5	Pvg dist. bnds.	City f'ds. Basis of 8c. per yd.	Satisfactory on level streets.
South Omaha	CaliforniaAlcatraz.	1	5	2.78	5	Cash.	.....	Steadamant asphalt base 5 ins. thick; pavement laid in fall and winter 1891 as now stands shows up much better than any Trinidad pavement in Omaha that has been down that length of time. Pavement laid in '91 shows up better than that laid last summer, which was made too hard to stand extreme cold weather.
Rochester	Trinidad Rock, Vulcanite.	2	6	2.50 to 2.60	5	⅓ cash, ⅓ time orders 1 yr.,⅓ 2 years.	No expirations. Cntrs est.cost 8c. per sq.yd.	Vulcanite not used now. Some pavements have proven satisfactory and some have not. Trinidad and rock give equal satisfaction.
St. Paul	Trinidad.	2½	6	About 2.75.	2; last contr. 5.	Cash.	City funds. 8 to 9c. pr sq.yd.	Satisfactory. Assessments made on abutting property and collected by city.
Kansas City	Trinidad Lake.	2		2.20 to 2.80	5	Special tax bills.	First guarantee expired; no contracts for maintenance.	Satisfactory. Believe that Bermudez, also California or Alcatraz, if properly prepared, will make a good pavement. Small quantity of California asphalt laid; result not good.
Denver	Trinidad Lake and Land. California.	2½	6	2.98	5	Imprvmt coup. bonds. llen on property.	City funds. No expirations.	Trying California asphalt; does not look well. Nothing proved by this failure except that company lacked experience and skill. Asphalt satisfactory in the main.
Indianapolis	Trinidad Lake.	2½	6	2.80 to 2.85	5	Cash and impvmt bonds.	No expirations.	Trinidad Lake asphalt is standard material. Others not in use long enough to demonstrate their standing. Ability to lay properly is very large consideration.
Allegheny	Trinidad Lake.	2	6	2.75	5	80% monthly est.; cash.[8]	City funds. No expirations.	Asphalt pavements have proven satisfactory. Prefer Trinidad Lake asphalt.
Albany	Trinidad Lake.	2	6	3.00 to 3.20	5	Cash as assessments collect'd.	City funds. No expirations.	Trinidad Lake asphalt used exclusively and satisfactory.
Columbus	Trinidad Lake. Trinidad Lake overflow. Kentucky rock.	2½		2.75	5	Cash monthly estimate.	Previous '93 repairs assessed abutting property. No data as to cost.	Very satisfactory; 10% retained for 5 yrs. or bond of 15% filed to guarantee repairs. "Vehicle tax" provides for street repairs at present. Trinidad Lake is given sole preference.
Syracuse	Trinidad Lake. Trinidad Land.	2½	6	About 2.45.	Usually 5, some cases 10.	Cash.	No expirations.	Satisfactory. Experience only with Trinidad variety. "Lake" and "Land" used with apparently equal success.
Atlanta	Trinidad Lake.	2½	6	3.05	10	Part cash, part 1, 2, 3 years.	City funds. No expirations	Satisfactory except on steep grades; where more or less slippery. Trinidad Lake fulfills all requirements.
Dayton	Trinidad Lake.	2½	6	2.50 to 2.60	5	Cash.	City funds. No expirations.	Satisfactory. Think Trinidad Lake superior to California asphalt. Bermudez has not been in use sufficient time to prove its qualities.
Troy	Trinidad Lake. Trinidad overflow.	2½	6	Av. 2.82, 5 yrs., 2.95, 10 years.	5 10	80% cash, 20% in 10 years, with int.	No expirations.	Much discussion as to relative merits of "Lake" and "Overflow." "Overflow" pavements down 1 yr.; asphalt first-class condition.
Grand Rapids	Trinidad Lake.	2½ 2	6 4	2.90 2.40	5	Warrants are cash'd when money is collected.	No expirations.	Satisfactory. One street kept wet to lay dust wears badly. Think California will crack in our climate. Not much difference between Trinidad and Bermudez.
Los Angeles	Natural bituminous limestone.	2	6	2.43 to 2.70	[7]	Cash, or 10 yr. bonds, 1-10 paid annually	City funds.	Satisfactory when properly laid. Some streets laid have stood 6 yrs.; are as good as when first laid.
Oakland	Bituminous sandstone.	..		1.62 to 2.25	None.	Assessment.	No expirations.	Have had but little experience with asphalt pavements.
Salt Lake City	California bituminout rock. Utah asphalt.	2½	6	2.79 to 3.25	5	Cash.	City funds.[9]	Satisfactory when proper material used. In Utah asphalt cracks have appeared, attributed to lack of skill in tempering to meet changes of temperature. California bituminous rock gives best results
Utica	Trinidad Lake. Bermudez.	2½	6	Formerly 2.90, now 2.30 & 1.90.	5 and 10	City ⅓ cash, property ⅔.	City funds.	Satisfactory. Paid $2.90 for Trinidad for years, but present Mayor fought them, brought in competition, and this year have laid about 3 miles asphalt pavement at $2.30 and $1.90. Bermudez properly laid is best on the market.
Erie	Trinidad Lake.	2	5	3 with grading & curb.	10	Cert. bills agst. prop'ty owners	General funds. Few expirations.No data	Satisfactory. City pays for street intersections.
Harrisburg	Trinidad Lake.	2½	6	About 2.75.	5	Cash & bonds; prop'ty owners 10 yrs. to pay in.	Nothing yet for repairs; pavement down 6 years.	On whole, satisfactory. There is question as to city's liability. Work has been stopped by adverse decision of the Supreme Court.
Wilkesbarre	Trinidad Lake.	2½	6	2.65	5	Assessments.	City funds. No expirations.	Satisfactory. Have had experience with none but Trinidad.

DATA REGARDING ASPHALT PAVEMENTS IN VARIOUS CITIES OF THE UNITED STATES.—(Continued.)
Compiled by Mr. H. P. Langworthy, Secretary of the Board of Public Works of Kansas City, Mo.

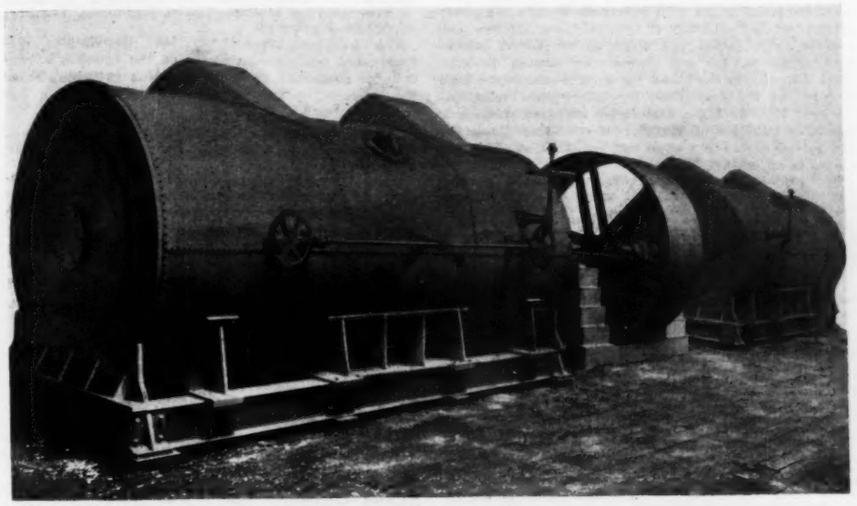
City.	Kinds of asphalt.	Thickness, ins. Asphalt.	Thickness, ins. Concrete.	Cost, sq. yd. $	Guarantee, yrs..	Payment.	Repairs guarantee expired) how p'd.&cost.	Remarks.
Yonkers	Trinidad Lake.	2	6	Av. 2.94	5	City warrants; cash, 30 days after assmt.	No arrangements. beyond 5 yrs.	Satisfactory.
Stockton	California, Santa Cruz.	2¼	6	1.80	None.	Assessment on property.	No repairs yet.	Have given satisfaction when concrete foundation is good.
Fresno	Santa Cruz. Bituminous rock.	2	6	2.25 to 2.75	2	Contrs collect from propty; Pd, 60 days.	City funds. No repairs required yet.	Satisfactory. Pavements been down 4 yrs. In extreme hot weather, pavement becomes elastic like India rubber, but does no injury.
Sedalia	California.	½ to 2	6[3]	1.80 to 2.00	5	Special tax bills.	No expirations.	Generally satisfactory. California will make as good pavement as Trinidad or Bermudez.
Long Branch.....	Trinidad Lake.	2½ 2	6 4	2.65 & 2.90	5	½ cash and ½ bonds.	Under present law, paid out "hotel license fund."	Satisfactory. One-half cost pavement paid out of fund created from hotel licenses, the other half by property on street.
Montreal.	Trinidad Lake. Sicilian rock.	2½	6	Lake, 2.80 to 3.43 Rock, 3.39 to 3.90	15	Cash.	City funds. No repairing yet.	Satisfactory. Cracks have appeared in Trinidad asphalt pavements where no traffic over them, but close up again in warm weather. Both kinds very good.
Toronto	Trinidad Lake and Land.	2 2½	4 6	About 1.90 to 2.30	5	Cash.	Contrs.must extend guarantee additional 5 years if required. No data.	Satisfactory; slippery under certain states weather; disintegrate if not properly drained. Repairs about 1 to 15 cts. per annum from contractor's figures. Pitch Lake gives best results.
Scranton	Trinidad Lake.	2½	6	2.65	5	Bonds.	City funds; 5c. per sq. yd. for No. of yds. in orig.contract.	Have proved satisfactory generally.
Topeka	Trinidad Lake.	2½	6	2.80	5	Cash.	City funds. No data.	Not very satisfactory; one asphalt as good as another if properly refined.

[1] Except Class A. [2] Standard. [3] Special. [4] Except Class A, 5 ins. concrete. [5] Asphaltic concrete, 4, 5 and 6 and 1½ ins. thick. [6] Telford base on some streets. [7] Under state law no guarantee can be given. [8] Balance on acceptance work. [9] Optional to require contractors to keep pavement in repair for additional ten years at 8 cts. per sq. yd. for each sq. yd. laid. [10] Under a query asking which pavement gives best results, answer was "both good."

WATER-POWER ELECTRIC PLANT AT WOONSOCKET, R. I.

The Woonsocket Electric Machine & Power Co., of Woonsocket, R. I., recently purchased a water-power plant, located near the center of the town, and has been equipping it with machinery for the generation of electricity by water-power. The following is a description of the features of principal interest:

The power is developed by two pairs of 36-in. cylinder gate Victor turbines, mounted on a horizontal shaft and developing about 600 HP. when working under the normal head of 17 ft. These



VICTOR TURBINES FOR WATER POWER ELECTRIC PLANT OF WOONSOCKET ELECTRIC MACHINE AND POWER CO., WOONSOCKET, R. I.

wheels were built by the Stilwell-Bierce & Smith-Vaile Co., of Dayton, O., and are illustrated in the accompanying engraving. As there shown, each pair of turbines is mounted in a separate wrought iron flume, which rests on double steel I-beams supported by the wheel-pit walls. The water is conveyed to these flumes from the forebay outside of the building by two wrought iron feeder pipes, which enter the flume nearly over each turbine. Each feeder pipe is supplied with a head gate, by which the water can be entirely shut out of the flume in case it is necessary to enter it for examination or repairs. The flumes are supplied with covers at each end, which can be removed, leaving an opening large enough to remove any part of the turbines, if it is ever found necessary to do so from accident or other cause. Each pair of turbines discharges into one draft tube, and with this arrangement, the two turbines discharging toward each other, no steps are required when both turbines are running, as all the end thrust is balanced; but as the gates of these turbines are arranged so that one turbine of each pair, or one pair and one turbine of the other pair may be run, steps have been supplied. Each pair of turbines has a governor for regulating the speed. These governors and the hand wheels for operating the gates are located on the floor above the wheel room.

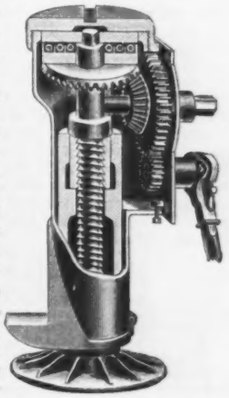
Midway between the two flumes is the main driving pulley, which is 11 ft. in diameter, with width of face sufficient for a belt 48 ins. wide.

The speed of the turbine shaft is 133 revolutions per minute, and with a pulley of the above diameter a belt speed of 4,595 ft. per minute is obtained. This pulley is keyed to a steel shaft 7⅜ ins. in diameter, which runs in self-oiling swivel boxes. Connecting each end of the shaft which carries the large driving pulley with the shaft from each pair of turbines is a Worrell friction clutch coupling, so that the pulley may be driven by either or both pairs of turbines.

On the floor above the wheels, running parallel with the front of the building, is a line of 6-in. shafting, with a receiving pulley of 51½ ins. face and 64 ins. in diameter, connected with the wheel shaft by a three-ply belt 50 ins. in width. To the left of the receiving pulley are three driving pulleys, each 69 ins. in diameter and 15½ ins. face, each operated by a Worrell or Laconia friction clutch. These pulleys drive the power generators by 15-in. three-ply belts.

These generators are installed on massive brick and stone foundations reaching to solid ground 10 ft. below the water line. To the right of the receiving pulley is another pulley 69 ins. in diameter, with a 15-in. face, operated, as are the others, by a Laconia clutch, which will be used to transmit power to the rooms above, which may be leased for manufacturing purposes.

BALL-BEARING JACK FOR HEAVY BRIDGE WORK.



We illustrate herewith a screw jack designed especially for heavy bridge work and made with gearing between the lever and the screw, enabling a small force of men to cope with very heavy work. The jack is 26 ins. in height, with a base 12 ins. in diameter, and has a total rise of 26 ins. Its weight complete is 250 lbs. The shell and standard are of malleable iron. The screw is 2½ ins. in diameter, of tool steel, with "brace" or "ratchet" threads, four to the inch. The screw turns in a 4-in. phosphor-bronze nut. All the gears are of cast steel and are cut from the solid. The lower shaft and its gear are cast in one piece, so that there are no pins or keys to work loose.

As seen by the cut, the jack has two speeds. With the lever connected to the upper shaft, light loads of 30 to 40 tons can be lifted, but when a load up to the full capacity of the jack is to be handled the lever is moved to the lower shaft. In a recent test at the Massachusetts Institute of Technology a weight of 73½ tons was lifted. A prominent advantage claimed for this jack is that it can be left standing for a long time with the load on it and will not run down nor stick when started. The ball-bearing head eliminates the chief source of friction and sticking in a screw jack, and the phosphor-bronze nut can never rust to the threads of the screw. The jack is manufactured by A. O. Norton, 97 Oliver St., Boston, Mass.

PERSONALS.

Mr. S. B. Wilson has been appointed City Engineer of De Land, Fla.

Mr. Jeremiah O'Rourke, Supervising Architect of the Treasury Department, has resigned.

Mr. W. S. Lincoln, Chief Engineer of the Wabash R. R., has not resigned, as stated recently.

Mr. John W. Stengele, an engineer in the office of the city surveyor of Portland, Ore., died Sept. 16.

Gen. George L. Becker has resigned his position as Railway and Warehouse Commissioner of Minnesota.

Mr. B. Marion, of Vicksburg, Miss., Superintendent of Bridges and Buildings, Chesapeake & Ohio Southwestern Ry., has resigned his position.

Mr. S. C. Stickney has been appointed General Manager of the Chicago Great Western Ry. He has been Acting General Manager since the resignation of Mr. John N. Egan.

Mr. E. W. Jackson, Vice-President and General Manager of the Mexican Central Ry., has resigned, to accept the position of President and Manager of the Interoceanic Ry.

Mr. E. B. Leisenring, President of the Lehigh Coal & Navigation Co., and one of the great Pennsylvania coal operators, died at Hamburg, Germany, Sept. 20, at the age of 49.

Mr. Ernest S. Cronise, recently with Henry R. Worthington, has opened an office as a commission dealer in machinery and railway supplies at 37 Broad St., New York City.

Mr. A. N. Connett, M. Am. Soc. C. E., has been appointed Chief Engineer of the Metropolitan Ry., of Washington, D. C., and will make an investigation of the various electric conduit systems. He built the Seventh St. cable line of the Washington & Georgetown Ry., and has been for some time the Chief Engineer of the City Passenger Ry., of Baltimore, for which he built 20 miles of cable and 23 miles of electric road.

Gen. William Ward Duffield, of Detroit, Mich., has been appointed by the President Superintendent of the Coast and Geodetic Survey, to succeed Prof. T. C. Mendenhall, resigned. General Duffield is a civil engineer. He was a resident engineer of the Hudson River R. R. in the fifties and was later Chief Engineer of that road. He is said to have built that part of the Grand Trunk Ry. lying between Detroit and Port Huron; was Chief Engineer of the Central Track R. R., in Illinois, now part of the Chicago, Burlington & Quincy system, and built other lines now forming part of the system. He was Chief Engineer of the Kentucky Union Railway, and of several railways in Michigan. In 1871-72 he was engaged in surveys in Colorado, and in 1882 was assistant engineer in the government survey of Dakota. In military life he served in the Mexican War, and was wounded at Cerro Gordo and at Contreras when acting on the staff of Gen. Gideon J. Pillow. In the civil war he was first Lieutenant-Colonel of the 4th Michigan, and was later Colonel of the 9th Infantry, under General Sherman. He was made a Brigadier-General in 1862 and commanded the 14th Corps of the Army of the Cumberland, under General Thomas. He was finally disabled by two wounds received at Murfreesboro and was breveted Major-General for gallantry in the field at that battle. The only political office previously held by him is that of State Senator of Michigan.

NEW PUBLICATIONS.

(Any book noticed in this column will be sent postpaid by Engineering News Publishing Co. on receipt of price.)

PROCEEDINGS OF THE MASTER CAR BUILDERS' ASSOCIATION, 1894. John W. Cloud, Secretary, The Rookery, Chicago. 8vo; paper; pp. 463.

This is the full verbatim report of the 28th annual convention, held at Saratoga last June (Eng. News, June 14 and 21). The reports of the Master Car Builders' meetings grow in value and importance year by year, and the present volume is doubtless the best which the association has ever issued. Among the subjects on which valuable committee reports were presented, we may mention especially car ventilation, lubrication, tests of brakeshoes, gage of wheels and tests of air-brakes and M. C. B. couplers. The volume contains as usual drawings showing all the standards of the association now in force.

TRAUTWINE'S CIVIL ENGINEER'S POCKET-BOOK. 16th edition; 45th thousand. Revised by John C. Trautwine, Jr., C. E. 1894. New York: John Wiley & Sons; London, E & F. N. Spon. 12mo; tucks; 866 pp.; $5.00.

The new edition of this well-known pocket-book has added to it an article on blueprints, fully describing the process, and also some further remarks upon the distribution of pressure in joints. A new chapter gives the definitions of railway curves, plainly illustrated, and a table is added of the Greek alphabet, with the approximate English equivalents, and the mathematical equivalents of these letters as commonly used. Trautwine's Pocket-book has so long been familiar to engineers that any further review of the contents of the new edition is superfluous information. It is simply a book that every engineer, and every one interested in engineering in any of its branches, must have.

A MANUAL ON TOPOGRAPHIC METHODS. By Henry Gannet, Chief Topographer, U. S. Geological Survey. J. W. Powell, Director. Washington: Government Printing Office. 1893. Folio; cloth; pp. 300; many colored illustrations and folding map; $1.00. Address Director, U. S. Geological Survey, Washington, D. C.

This is a government publication, so valuable to those interested in the special work which it describes, so handsomely published and so low in price, that engineers should know more about it. This work of Mr. Gannet's commences with a detail of the various government, state and railway surveys; describes the plan of the United States maps, their scales, contour and topographical features, size, etc. The next chapters take up the classification of work, organization of parties, astronomical work, primary and secondary triangulation, base line measurements, plane-table and traverse work, etc. Sketching and the origin and special form of topographic features are described in a special chapter and illustrated by beautifully colored specimen maps. Another chapter treats of office work. The appendix contains 29 tables especially useful in topographic work, including many tables for correction, conversion, differences and co-ordinates for projection of maps on different scales. The work, in fact, is what it claims to be—a manual on topographic methods, compiled by the chief authority on the subject in the United States, and embodying the latest practice and instruments.

ELECTRIC LIGHTING PLANTS: THEIR COST AND OPERATION. Data Compiled from Station Reports of Electric Lighting Plants Employing Overhead Circuits, with Suggestions Pertaining to the Information Usually Desired by the Non-Technical Purchaser. By W. J. Buckley. Chicago: Wm. Johnston Printing Co. 8vo; pp. 275; illustrated; $2.

This book is somewhat of a departure from the general character of the literature on electrical work in that it deals more particularly with the cost of equipment and operation of the plant, the book being intended specially for the use of intending purchasers of such plants, and giving them such information as may aid in forming a fair estimate of the cost of construction and operation of the station. The writer is a salesman of the Fort Wayne Electric Co., and has, therefore, mentioned only the Wood lighting apparatus, for which he offers an apology, stating that in all other ways impartiality has been observed. Details are given of the cost and efficiency of fuel, oil, labor, boilers and engines (with tables and diagrams of power, prices, etc.), dynamos, arc and incandescent lamps, the various instruments used, and the wiring. There are also instructions for employees, the underwriters' rules, the National Electric Light Association standard rules, and tabular statements of the cost of operating municipal and private plants in a large number of cities. The following is an extract from the introduction:

The prices given on the construction cost of the items of building, steam plant and wire circuits, also the cost of operating arc and incandescent lamps, are compiled from reports received from almost all the electric lighting plants in the United States and Canada, and are scheduled according to their capacity. The data given are confined to stations of modest capacities employing overhead circuits; stations of large capacity with underground circuits are not considered, but will be treated in a second work now being prepared for publication.

A careful analysis of the reports shows that while the cost of fuel and labor varies, according to locality and facilities, the cost of production of light and the revenues derived therefrom adhere to a general average. The reports indicate that the electric lighting station, if properly managed, offers opportunities for large returns on the investment; but, perhaps more than any other business, affords unlimited chances for numerous small leaks, which, taken in the aggregate, will soon equal the revenues derived, unless carefully drawn within the limit of necessary expenditure. Of the operating stations, 12.6% are losing money; with 10.8% the receipts barely cover running expenses, while 76.6% are making money ranging from 2% to 51% yearly on the investment.

STEAM TABLES AND ENGINE CONSTANTS. For facilitating all calculations upon indicator diagrams, or various problems connected with the operation of the steam engine, from reliable data and with precision. Compiled from Regnault, Rankine and Dixon, directly, making use of the exact records. Every table in this work was computed, not copied. By Thomas Pray, Jr. C. C. and M. E., member of many societies. New York: D. Van Nostrand Co., and London, E. & F. N. Spon. Cloth; pp. 85; $2.

The publication of a new book of steam tables by the author of "20 Years with the Indicator," a book which is said to have had a sale of 12,000 copies, will interest many steam engineers. It would naturally be supposed that as the author is himself an engineer of much experience, he would prepare a book well suited to the wants of practicing engineers. We are disappointed at the outset, however, by the defective arrangement which the author has adopted. Instead of putting the text explaining each table with the table itself, all the explanations are bundled together in the first part of the book and all the tables are in the back part, and the tables carry no hint of where the matter explaining their use may be found. The fact is that the author has neglected to do what every writer of a good technical book ought to do—viz., put himself in the place of the most ignorant and stupid user of the book, trying to imagine his difficulties, and to devise methods of avoiding them. It is not alone in this respect that the author's failure to write so that he who runs may read is evident. In the table headings, letters and figures are freely used, and the reader must turn back several pages sometimes or rely on his knowledge of arbitrary signs customarily used in steam calculations, to tell what these letters or figures really signify. Another thing which makes the author's explanations difficult to follow, even by the expert reader, is his misuse of the English language. We refer especially to the use of enormously long sentences, strung together with little regard to the laws of syntax; and to add to the confusion the author tosses into the midst of the chaos ideas quite irrelevant. Opening the book at random we find on p. 12 a single sentence containing 317 words. The author's especial claim for his book is reliability, and he states in his preface that he and his son have computed all the tables; he fails to state, however, by what method they were computed or to what extent the computations were checked, so the reader must take the author's figures on trust, as he does in using tables by any other author.

These various faults will interfere with the usefulness of the book to many engineers; but to many others, who are entirely familiar with the subject to which these tables relate, the defects we have pointed out will be of small moment and the convenience of having all the tables generally used in steam computation brought together in one volume will make the book very welcome to them. The tables themselves are exceedingly commendable, the type having an excellent face, and the figures being not at all crowded. The computations are carried out to a sufficient number of decimals to make the figures available for the most important class of work, such as that in connection with computations concerning modern naval engines.

TRADE CATALOGUES.

MULTIPOLAR GENERATORS AND MOTORS. Westinghouse Electric Manufacturing Co., Pittsburg, Pa.

This is a very neatly printed and illustrated description of multipolar generators and motors, in sizes from ¾ HP. upwards. In it is a wire table, showing at a glance the size of wire necessary for the transmission of any given amount of energy over a given distance with a given drop in potential. This table is arranged for 100-volt and 500-volt circuits.

RICHMOND COMPOUND LOCOMOTIVE. Richmond Locomotive & Machine Works, Richmond, Va. 8vo; pp. 26; illustrated.

This pamphlet gives illustrations, descriptions, diagrams and performance sheets of the company's two-cylinder compound locomotives, which (with details of the intercepting valves) have been described in our issues of May 10 and 31, 1894.

CONTRACTORS' TOOLS AND MACHINERY.—Thos. Carlin's Sons, Allegheny, Pa. 8vo; pp. 176; illustrated.

This is a catalogue of contractors' plant, and includes almost every variety of tool, machine and appliance necessary for this character of work. The catalogue is handsomely and profusely illustrated, and dimensions, prices, etc., are given in detail. It is a very handy and useful publication for all interested in contracting or in general construction.

TIE PLATES. By Wm. Goldie. Dilworth & Porter, Pittsburg, Pa. 8vo; pp. 31; illustrated.

This pamphlet is a reply to one by Mr. Benjamin Reece, its object being to claim advantages for the Goldie tie plate, which has a sharpened lug at each corner, cutting across the grain of the tie, over the Servis tie plate, advocated by Mr. Reece, which has flanges running lengthwise of the grain of the tie.

SOCIETY PROCEEDINGS.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the meetings on Sept. 19, held simultaneously at the house of the American Society of Mechanical Engineers in New York city and at the Armour Institute, Chicago, papers were read on "The Residual Charges of Condensers and their Dependence on Temperature," by Frederick Bedell and Carl Kinsley, and on the "Electric Brake in Practice," by Elmer A. Sperry.

NEW YORK RAILROAD CLUB.—The first meeting of the season was held on the evening of Sept. 20, at the rooms of the American Society of Mechanical Engineers, and nearly a hundred were in attendance. The paper of the evening was by Mr. W. W. Wheatley, Car Accountant of the West Shore R. R., on the topic, "How Can the Present Methods of Rating Train Loads be Improved?" The paper was discussed at much length by Superintendents Bradley, of the West Shore; Donnelly, of the Lehigh Valley; Watson, of the West Shore, and others.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT.—At the meeting of Commissioners of Public Works at Buffalo on Sept. 19, a permanent organization was effected under the above title and officers were

elected as follows: President, M. J. Murphy, of St. Louis; Vice-President, G. H. Benzenberg, M. Am. Soc. C. E., of Milwaukee, and Geo. L. Gatchell, of Buffalo; Secretary, D. L. Fulton, of Allegheny City, Pa.; Treasurer, A. Joralemon, of Newark, N. J. It was voted to hold the next annual meeting in Cincinnati, convening on Sept. 12. The day following the meeting was spent in an excursion about Buffalo Harbor and to Niagara Falls, in company with many prominent citizens of Buffalo.

WESTERN RAILWAY CLUB.—The second annual banquet was held at the Union League Club, Chicago, on the evening of Sept. 18. President Geo. Gibbs, Mechanical Engineer of the Chicago, Milwaukee & St. Paul, presided. In the after-dinner speeches Mr. Wm. Forsyth compared American and German methods of railway management, and commended the American system as the best for fostering progress. Mr. Willard A. Smith, speaking to the toast "Railroad Education," referred to the railway as the greatest of educating influences, and thought that education would yet solve the problem of relations with employees. Mr. Godfrey W. Rhodes, speaking on "Lessons of the Recent Strike," thought that greater thrift among employees would tend to reduce strikes.

AMERICAN STREET RAILWAY ASSOCIATION.—The thirteenth annual meeting will be held in Machinery Hall, Piedmont Park, Atlanta, Ga., Oct. 17, commencing at 10 a. m., and continuing three days. Special committees will report on the following subjects: "A Standard Form of Street Railway Accounts;" "Can the T-Rail be Satisfactorily Used in Paved Streets?" "City and Suburban Electric Railways;" "Mail, Express and Freight Service on Street Railway Cars;" "Standards for Electric Street Railways;" "Street Car Wheels and Axles;" "The Best Method of Treating Accidents and Complaints;" "The T-Rail Construction of the Terre Haute Street Railway," and "Transfers and Commutation." Notice has been received by the Secretary that special papers will be read on the following subjects: "A Practical System of Long Distance Electric Railway Work;" "Brakeshoes," and "Destructive Arcing of 500 Volt Fuses."

The Executive Committee has secured Machinery Hall, at Piedmont Park, Atlanta, for the exhibition of street railway supplies. The building has been engaged for two entire weeks, beginning Oct. 10 and ending Oct. 24; thereby giving ample time for the setting up and removal of the largest exhibits. The room for the meeting is also in the same building on the main floor, and delegates will therefore be enabled to examine the exhibits to the best advantage, and with the least possible loss of time. The exposition will be in charge of the Secretary, assisted by Mr. N. W. L. Brown, of the Atlanta Consolidated Street Ry. Co. Applications for space, if not already made, should be sent without delay direct to Mr. Brown, at Atlanta.

Wm. J. Richardson, Secy., Brooklyn, N. Y.

AMERICAN SOCIETY OF IRRIGATION ENGINEERS.—The second annual convention, recently held at Denver, though not large in numbers, was a very pleasant and successful meeting, giving evidence of continued interest in the society, and the work it is designed to accomplish. The brevity of the notice given and the depressed state of affairs doubtless combined to make the attendance smaller than it otherwise would have been. The call for the convention gave Sept. 10 as the opening day, but in view of the fact that many of the members had been in attendance on the International Irrigation Congress for a week, and desired to leave the city, the first session was held on Sept. 8. Among those present were L. G. Carpenter, President, Fort Collins, Colo.; Wm. Ham. Hall, Vice-President, San Francisco, Cal.; John S. Titcomb, Secretary and Treasurer, Denver, Colo.; C. L. Stevenson, Director, Salt Lake City, Utah, and 40 others, members and visitors, representing ten states and territories, as well as Canada and Mexico.

The Treasurer's report showed receipts from all sources of $903.70, and expenditures of $857.25, leaving $46.45 in the treasury.

The letter ballots for officers were opened and canvassed, resulting in the election of the following named for the ensuing year: President, James P. Maxwell, Boulder, Colo.; Vice-President, Edward M. Boggs, Tucson, Ariz.; Secretary and Treasurer, John S. Titcomb, Denver, Colo.; Board of Directors, George G. Anderson, Denver, Colo.; Samuel Fortier, Logan, Utah, and James B. Schuyler, San Diego, Cal.

The Secretary reported that the Annual was all printed except the advertising pages, and a few advance copies were laid before the convention for examination. The entire edition will be out this month, and a copy will be sent to every member who has paid the admission fee. It will contain 270 pages.

An excursion was given by the Citizens' Water Co., of Denver, under the guidance of Mr. C. P. Allen, Chief Engineer; a visit being made to the reservoirs, filter works, etc. The session closed at a late hour on Monday evening, Sept. 10, a number of papers having been presented, read and briefly discussed. These papers, with others in the hands of the Secretary, will soon be published, as it has been decided to publish papers periodically, probably quarterly. These will be sent out to members at once, and any written discussion on any paper will, if received by the Secretary within 80 days, be published in the next quarterly number. The Secretary has on hand copies of the Proceedings of the Irrigation Congress held at Salt Lake City in 1891. These can be had at 10 cts. per copy for postage, etc.

John S. Titcomb, Secretary.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on Sept. 19, Mr. E. A. Hermann addressed the club on "Reconstruction and Improvement Work on Railways," stating that nearly all roads when constructed passed through thinly settled country, affording little traffic. The certainty that only very small earnings would be possible for a number of years presented the alternative of a cheap and poorly built railway, or none. Consequently the new road when opened for business was generally barely substantial enough to permit the locomotive to pass over it at a very moderate speed.

Before beginning construction very little time was devoted to surveys. Errors in location were frequent. The line was full of curves, and the grade followed the general surface of the ground as nearly as possible. The track, trestles, bridges, depots, shops, etc., were also as cheap as they could be made, but all this flimsy construction was justified and necessitated by the circumstances: the opening up of new country with little business in sight.

The best part of the new road was the rolling stock—locomotives with much fancy brass ornamentation, and passenger cars whose interior was gorgeously painted. But this cheap splendor did not counterbalance the miserable construction of roadway and structures. With rapidly increasing traffic these soon began to go to pieces, and the work of reconstruction followed as a disagreeable necessity. This generally began with the renewal of the track ties, followed by trestles, bridges, rails, ballast, depots, shops, water tanks and minor structures. Then came a large field for improvements: Re-alinements for reducing curvature and shortening the line, cutting down steep grades and raising depressions. The further rapid growth of traffic soon necessitated other improvements, notably side tracks and yards, double main track, interlocking signals at grade crossings, stone culverts, better bridges, heavier rails, stone ballast, better depots, warehouses, grain elevators, stockyards, etc.

The reconstruction and improvement of our railways have progressed slowly but steadily. A vast amount of reconstruction remains to be done. Increased traffic will necessitate more reconstruction and further improvements, and increased earnings will permit them to be carried out. Comparatively few of our railways can be said to be more than half finished, and they never will be quite finished. When the reconstruction work is believed to be completed, improvements will still be necessary.

In the discussion the unsatisfactory character of the present type of rail fastenings was mentioned, and there was also some discussion on the welding of rails, but there appears to be as yet insufficient information upon which to base an opinion as to the merits of the system.

Wm. H. Bryan, Secy.

STREET RAILWAY ASSOCIATION OF NEW YORK.—The twelfth annual meeting was held at Syracuse, N. Y., on Sept. 18. Delegates were present from 12 railway companies and the total number in attendance was nearly 50. The President of the Association, Mr. D. B. Hasbrouck, Vice-President of the Metropolitan R. R. of New York city, addressed the members, congratulating them that, while the business depression had affected the revenues of the companies, they had suffered neither blizzards nor tie-ups during the past year.

The report of the executive committee showed that 30 companies are now members of the association, one company having withdrawn and two having joined during the year. For the especial work of protecting street railway interests in the legislature, the committee has employed Mr. Charles J. Bissell, of Rochester, and through his efforts oppressive legislation has been prevented. The year's obituary record includes the names of William Richardson, Henry W. Slocum and Edward F. Drayton. The treasurer's report showed receipts of $5,800 and expenditures of $5,381, leaving $479 in the treasury.

Mr. J. B. Craven, Electrician of the Buffalo Street R. R. Co., read a paper on "Economy in Power-House Operation." He thought the boiler-room was frequently the place where greatest waste occurred and advocated good boilers, careful and intelligent firing, clean boilers and well protected boilers and steam pipes as the best means of reducing the loss. Feed-water should be heated, and where the steam plant is run condensing, this can be effectively secured by running a small engine non-condensing and heating all the feed with its exhaust. In the Buffalo station one-seventh of the engine capacity is run non-condensing, and heats the feed-water from the hot-well temperature (110°) to 194° before it enters the boilers. In the engine-room the author favored the direct connected rather than the belted type, and the use of as large units as possible without making them so large that a breakdown would cripple the plant. It is economy to employ a thoroughly competent engineer, even if he commands higher wages than an ordinary man. In the Buffalo station one engineer used $640 more oil in six months than another, yet the second man got more work out of his engines. In conclusion, he called attention to the value of a good return circuit of low-resistance in economizing power.

In the discussion on this report, Mr. Craven in response to questions, said that he would advise using direct-connected engines, even on small roads, operating 15 to 25 cars. He said that the Buffalo Ry. keeps its boilers free from scale by injecting kerosene, about a pint in the course of a 10-hours' run, and finds the results very satisfactory. Referring to the use of a separate return wire, he thought that a road six miles long operating ten cars was large enough to need a return wire.

The paper by Mr. G. W. McNulty, on "Recent Improvements in Cable Traction," printed in our last issue, was then read, and was followed by a paper by Mr. Allen R. Foote on "Taxation."

The election of officers followed, and resulted as follows: President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, William W. Cole, Elmira; Secretary and Treasurer, William J. Richardson, Brooklyn. Executive committee: D. B. Hasbrouck, New York city; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

Albany was selected as the place for holding the next annual meeting, and the convention then adjourned. In the afternoon the visitors were driven about the city and an inspection was made of the new track being laid by the Syracuse Street Ry. Co.

COMING TECHNICAL MEETINGS.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Oct. 1. Secy., C. L. Annan, City Engineer's Office.
AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 2 to 6. Bridgeport, Conn. Secy., R. W. Raymond, New York.
WESTERN SOCIETY OF ENGINEERS.
Oct. 3. Secy., Thomas Appleton, Lakeside Bldg. Chicago.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Oct. 3. Secy., Francis Collingwood, 127 E. 23d St., N. Y.
ENGINEERS' CLUB OF ST. LOUIS.
Oct. 3. "Motions of Soaring Planes." Secy., W. H. Bryan, Turner Block.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Oct. 5. Secy., O. Von Geldern, 719 Market St., San Francisco.
ENGINEERS' CLUB OF PHILADELPHIA.
Oct. 6. Secy., L. F. Rondinella, 1122 Girard St.
WISCONSIN POLYTECHNIC SOCIETY.
Oct. 8. Secy., Geo. G. Mason, 144 8th St., Milwaukee.
ENGINEERS' CLUB OF KANSAS CITY.
Oct. 8. Secy., Waterman Stone, Baird Building.
NORTHWEST RAILWAY CLUB.
Oct. 9. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
NORTHWESTERN SOCIETY OF ENGINEERS.
Oct. 9. Secy., D. W. McMorris, Burke Bk., Seattle, Wash.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Oct. 9, 11. Secy., F. C. Osborn, 721 Hickox Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
Oct. 9. Secy., F. Ed. King, 36 Jacobson Block.
NEW ENGLAND RAILROAD CLUB.
Oct. 10. Secy., F. M. Curtis, P. O. Box 1570, Boston, Mass.
ENGINEERS & ARCHITECTS' CLUB OF LOUISVILLE.
Oct. 11. Secy., G. W. Shaw, Norton Building.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Oct. 11. Secy., C. H. McLeod, 112 Mansfield St. Montreal.
ENGINEERING ASSOCIATION OF THE SOUTH.
Oct. 11. Hunter McDonald, Nashville, Tenn.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Oct. 13. Secy., G. O. Foss, Helena, Mont.
ENGINEERS' CLUB OF INDIANAPOLIS.
Oct. 13. Secy., C. C. Brown.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 14. Secy., D. W. Meeker, St. Paul, Minn.
ENGINEERS' CLUB OF MINNEAPOLIS.
Oct. 15. Secy., E. Nexsen, Kasota Block
ASSOC. SUPERINTENDENTS OF BRIDGES & BUILDING.
Oct. 16. Kansas City, Mo. Secy., S. F. Patterson, Concord, N. H.
WESTERN RAILWAY CLUB.
Oct. 16. Secy., C. F. Street, Rookery Building.
COLUMBIAN ENGINEERING SOCIETY.
Oct. 16. Secy., F. W. Hart, Washington, D. C.
AMERICAN STREET RAILWAY ASSOCIATION.
Oct. 17. Atlanta, Ga. Secy., Wm. J. Richardson, Brooklyn, N. Y.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Oct. 17. Secy., J. H. Pilcher, Roanoke, Va.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Oct. 17. Secy., S. E. Tinkham, 36 Bromfield St.
ENGINEERS' CLUB OF CINCINNATI.
Oct. 18. Secy., J. F. Wilson, 24 W. 4th St.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Oct. 18. Secy., D. Carhart, Carnegie Library Building, Pittsburg.
NEW YORK RAILROAD CLUB.
Oct. 18. Secy., John A. Hill, Temple Court, N. Y. City.
AMER. SOCIETY OF RAILWAY SUPERINTENDENTS.
Oct. 20. New York. Secy., G. A. Hammond, Boston.
CENTRAL RAILWAY CLUB.
Oct. 24. Secy., S. W. Spear, East Buffalo Iron Works, Buffalo, N. Y.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Nov. 15. Atlanta, Ga. Secy., F. A. Charpiot, Macon, Ga.
SOCIETY NAVAL ARCHITECTS & MARINE ENGINEERS.
Nov. 15 and 16. Annual Convention in New York city. Secy., W. L. Capps, U. S. N., Washington, D. C.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 3 to 7. Secy., F. R. Hutton, 12 W. 31st St., New York.

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We have recently received several letters referring to the character and past record of one Francis F. Hopp, a civil engineer, who was in the employ of the city of Chicago some three years ago and had charge of the construction of the four-mile tunnel. More recently he was engaged as an inspector on levee work in Louisiana and was located in New Orleans during the early part of the present year. Mr. Hopp is described as a portly man, about 46 years of age, of excellent address and carrying good testimonials. Any of our readers who may know his present location or may be acquainted with his past record are requested to inform us.

We have had frequent occasion to note instances of the payment of very small fees to engineers, but it is not so often that an example of the opposite sort comes to our notice. Mr. Thomas C. Clarke, M. Am. Soc. C. E., has been appointed Chief Engineer of the bridge which the city of New York is soon to build over the Harlem River at Willis Ave. The chief dimensions of the bridge were given in our issue of July 26. Mr. Clarke is to furnish, at his own expense, his services, all necessary plans, all necessary inspections of iron and steel work at the shops while being made, a general inspection of masonry and piling, a general inspection of erection of iron and steel work and a general inspector of paving. His compensation is to be 4% of the cost of the work. The entire cost is estimated at about $1,300,000, which will give Mr. Clarke a gross fee of about $52,000.

It is not often that the government publishes and places on sale a work of especial interest and practical value to engineers generally. But in the Manual on Topographic Methods, written by the Chief Topographer of the U. S. Geological Survey, and noted this week in our column of new publications, we have a work that almost any engineer would be glad to possess. It is a mine of information on this subject; is beautifully illustrated and embodies in its text and many tables the latest practice in this important branch of the engineering profession. Its low price enables any engineer to own it who puts in an early application to the Director of the U. S. Geological Survey. We think it best to warn our readers that the edition is a comparatively limited one.

We discussed in our issues of Aug. 9 and 16 the controversy between some of the contractors on the Chicago Drainage Canal and the Board of Trustees over the difficult hardpan on some sections, which is so hard as to require blasting, yet is classified as glacial drift by the terms of the contract. As our readers know, Messrs. Streeter & Kenefick, the contractors on Section E, quit work several months ago, declaring that to excavate this hard conglomerate at the price they had bid meant financial ruin. They asked the trustees to allow a reclassification of the material, with the alternative of taking the matter into the courts. The trustees, however, decided that the contractors must be held by the plain terms of the contract, and ordered them to resume work within ten days under penalty of the forfeiture of their contracts. In accordance with this order the contract was declared forfeited, and the work was advertised for reletting, the Sanitary District being entitled to collect of the original contractors any excess in the cost of the work over the prices at which the work was originally let. When the bids were opened on Sept. 12, it was found, to the general astonishment, that the lowest bidder had actually gone below Streeter & Kenefick's original prices. These original prices were 27½ cts. per cu. yd. for glacial drift and $1.00 per cu. yd. for rock. The original quantities were 1,816,200 yds. of glacial drift and 5,000 cu. yds. of rock. The firm of Angus & Kindele, of Chicago, which submitted the lowest bid in the reletting, named 27 cts. and 70 cts. as its figures. Apparently the tough conglomerate which has caused so much trouble in this work is not so tough as has been claimed; or, at least, it appears to have no terrors for these new contractors. The various parties who have been positive that the material could not be excavated for the contract price will watch with interest to see how Angus & Kindele propose to handle the intractable stuff.

At the recent meeting of the New York Street Railway Association, a report of which is given in another column, Mr. A. R. Foote read a "volunteer" paper on the subject of "Taxation." The paper was very long, but we can give its gist in a few words. The author holds that it is unjust to make a street railway pay anything to the town or city in which it operates save a tax upon the value of its property, assessed at the same rate as taxes are assessed on all other property. It is so long since any one propounded this idea that Mr. Foote's proposition has quite an air of novelty. The chain of his argument is as follows: (a) All charges for the support of the government and for all other public purposes are taxes, (b) all property should be assessed at its full value in current funds, (c) the tax levy should be laid at a uniform rate on the assessed value of all property. All this sounds very plausible, but the weak point in it is that it is defective at its foundation. The very first definition does not correspond with the facts, and it would require an enormous set of changes to make it do so. The fact is that the percentage of gross receipts, or the annual rental per mile of track, or the annual car license fee which a street railway company pays are not taxes at all, in the common acceptation of that term. They are the rental which the company pays to the public for the privilege of using the streets. Certainly, so long as the public owns and controls the streets, it is nothing more than just for a street railway company to pay for the privilege of using them, provided that privilege is worth a rental. We doubt whether even Mr. Foote would contend either that this privilege was not worth a rental, in cases where rental is now paid, or that the public as the owner has not a right to collect such a rental. Mr. Foote makes great claims for the political purity which would be brought about by the revolution in taxation methods which he proposes; but he appears to overlook the fact that if street railway companies paid into the public treasury neither rental for the use of the streets nor a lump sum for their franchises, they would of necessity have to receive their franchises as a gift. The question would then be, what company would give the Board of Aldermen the most for that gift? At least, it used to work that way when giving away public franchises was far more common than it is now.

An event worthy of special notice is the award of the contract for three sewage pumping engines for Providence, R. I., each of which is to have a daily capacity of 36,000,000 gallons. So far as we recall, these engines will have the greatest capacity of any piston pumping engines in the world, with the single exception of a 60,000,000-gallon Leavitt engine at the Calumet & Hecla mines. The list of very large pumping engines previously built includes a 30,000,000-gallon sewage pumping engine for the Rotterdam, Holland, sewerage system, built by Henry R. Worthington in 1889, an engine of the same capacity by the same builders for the West Middlesex Co., of London, England, and two engines of the same capacity just completed by the Holly Manufacturing Co. for the Philadelphia waterworks. As stated in our last week's issue, Chicago is just asking bids for a 30,000,000-gallon triple-expansion engine for the 14th St. station. We recall no other pumping engines, either completed or in prospect, of so great a capacity as 30,000,000 gallons, but perhaps some of our readers may be able to add to this list. Of course, it will be understood that in power the Providence pumping engines will not be especially remarkable, as the head against which they work is low (27 ft.). The Chicago and Philadelphia engines and the enormous Cornish pumps at the Ontario Mine in Utah and the Lehigh Zinc Mine in Pennsylvania develop far more power. The movement toward the use of pumping engines of larger capacity is an important one; the advantages gained are increased duty, reduction in space occupied and in first cost, and reduction in the cost of attendance, since it requires about as large a staff to operate a 5,000,000-gallon engine as one of 30,000,000 gallons capacity. We may note also as a matter of interest that whereas three or four years ago there was hardly a triple-expansion pumping engine in the country, at present nearly every engine of very large size is being built with a triple-expansion steam end.

We noted in our issue of Sept. 6 a proposition recently made to the Commissioners of Cook County, Ill., for the erection by a syndicate of a county court house, containing space for all the county offices and seven or eight floors of offices to rent to the public. The syndicate offered to build this structure for $4,832,000, and take payment in 4% 20-year county bonds. The Cook County Commissioners, on Sept. 5, advertised for complete plans and specifications for such a building, to be sent in to their office by Sept. 26, all proposals to be accompanied by a certified check for $250,000 and bonds for $2,500,000 to be required upon the award of the contract. This "notice to architects and builders" has raised a storm of protest from some of those addressed, who regard it as an indication of intent to prevent all competitions with the syndicate, which has its plans prepared and ready to hand in. It looks very much that way, Chicago architects protest, that instead of 18 days, not including Sundays, being sufficient for the preparation of plans, it would take two months to prepare preliminary plans only for such a structure; and to make working plans necessary for complete and accurate estimates, on which bids could be safely made, it would take from four to six months, and probably a year, if due regard were paid to architectural effect. The certified check and bond features are also regarded as practically prohibiting any general competition by architects or builders. The architects want competition, not only because they believe that in this way only can the best design be secured, but also because the present plan deprives the profession of the fees on such a building, amounting, at 1½%, to $50,000 for the preliminary sketches alone. Others condemn the combination of county offices and public offices proposed, and say it would be as proper to build our churches in factories and combine art-museums and railway depots. They also question the public policy of permitting the Chicago officials to control a bureau for the rental of offices, in competition with citizens, and say that such an enterprise would open the door to corruption among public officials, some of whom are not altogether of savory repute.

All things considered, there seems to be sufficient reason for protests, even without questioning the advantages of the syndicate's proposition, which is so evidently favored by the hasty action of the Cook County Commissioners. The whole proposition is a novel one, and seemingly has merit and some economic advantages; but there certainly is no need for the haste shown, and there are many

reasons for preferring deliberate action and opening the door, at least, to the few competitors who could undertake an enterprise of such magnitude. While every city edifice should be an architectural monument of good taste, material and workmanship, there seems to be no particular reason in this case for utterly ignoring the element of revenue proposed. Real estate is too valuable in Chicago to permit the setting aside of the ample space required for the proper architectural display of an isolated public building; and it does not appear that this is intended anyhow. The new building is simply to cover the block now occupied by the old county court house, surrounded by sky-scrapers; and the conditions seem rather to require a tall structure than one of the three or four stories actually required for county use alone. As to the temptation held out for corrupt practice in handling this additional public revenue, it may be said that the citizens of Chicago are alone responsible for the character of the men they put in control. A large city requires a large revenue for its proper administration; and while we would not advocate the construction of offices for general rental by municipal bodies, as a rule, this does seem a case where it could be properly done, and the addition of $400,000 annually to the city revenue is a most important consideration. We note that one architect, who objects to this plan and advocates proper isolation for all public and semi-public buildings, and their separation from the office revenue element, dates his letter from the Masonic Temple. This structure is emphatically a monster office building; and in line with his previous argument he might as properly condemn the policy which led a powerful and wealthy body of Masons to build a structure for business purposes in connection with their headquarters, instead of erecting a suitable and dignified building, devoted to their use alone, in the middle of some city block. It is a case strictly in point; and the same policy, that of utilizing to the utmost valuable space, applies in both cases.

THE CITY OWNERSHIP OF STREET RAILWAYS.

A late decision of the English courts and the House of Lords has an important bearing upon the value of English and Scotch tramway lines when these are to be transferred to the local authorities. Under the act authorizing the construction of the London tramway lines it was provided that at any time within six months after the expiration of 21 years from the date of the act the Metropolitan Board of Works could require the company to sell to it its whole undertaking upon the payment of "the then value, exclusive of any allowance for past or future profits, any compensation for compulsory sale or other consideration whatever." The London County Council, the successor of the Board of Works, has asked for this transfer, and, in spite of the plain wording of the act, the tramway companies have contended that the valuation of their property must be arrived at in the ordinary way of finding what the rental would be and then allowing so many years' purchase of that rental. The County Council, on the other hand, said that the present value of the property was the cost of construction less depreciation.

The matter was finally submitted to Sir Frederick Bramwell, as arbitrator. He refused to accept evidence as to the actual profits on traffic, because the terms of the act did not authorize him to adopt a method of valuation based on years' purchase of profits. He at first did accept evidence to show the rental value, considered as let, or capable of being let to a tenant, but later declined to use it on the ground that the mode of valuation to which such evidence was directed involved an allowance for past or future profits within the meaning of the act. Sir Frederick practically based his award upon the opinion of expert witnesses as to the cost of construction and the depreciation of such value. This decision of the arbitrator was objected to by Mr. Justice Mathew, of the Divisional Court, who contended that the important words, "the then value," in the act meant that the present earnings were to be taken as a basis of value with the assumption that these earnings were made in the past and could be made in the future. He sent the award back to the arbitrator with instructions to take into consideration the actual profits made, but not to include compensation for compulsory sale or past or future profits. He further said that the view taken by the County Council meant partial confiscation of the property, an act not contemplated by Parliament in granting the franchise, or understood by the stockholders who furnished the money. The Court of Appeals, however, upheld the arbitrator's award and the House of Lords has now affirmed that decision.

The London County Council and the arbitrator both evidently took the ground that the practically free use of the city streets by the companies for the period named was an important element in the calculation of past and future profits of operation and company valuation of the property. To pay a price for what was already their own was absurd; and in considering the "then value" of the property they simply allowed the valuation of the actual plant necessary for operation, with a proper deduction for depreciation. This award may seem like "partial confiscation" from the shareholders' standpoint, but a little thought and study will show its justice.

Without the use of the streets the prospective profits of the company cannot exist at all, and a very great part of the gain in traffic, and thus in profits, is due to a general municipal growth entirely outside of all efforts of the company. In return for an expenditure for track, buildings, equipment and operating expenses the company had the use of the streets for a merely nominal tax, as a rule, and for a long period of years had practically the sole benefit from the traffic growth in the city. The London act quoted evidently assumed that this return was amply sufficient upon the actual expenditure for equipment and operation, and that the purchase of the plant existing at the time of transfer would mete out full justice to the shareholders. If the latter did not anticipate an award of this kind and scale the value of their stock as the time limit expired, that was their own error of judgment, for which the city was not responsible.

The question of ultimate municipal ownership of street railway lines, as contrasted with the indefinite private control of public streets, is now being very generally discussed, and honest public opinion decidedly leans in the direction of such ownership by the city, and provisions therefor should be made in the letting of all street franchises. The problem is now being worked out in Detroit, Mich., and notably in Toronto, Canada. In the latter city the 30-year lease of the street railways expired in 1891 and the municipality exercised its privilege of purchase. The award was made by arbitrators in this case, and the sum paid was about $1,500,000. Instead of attempting to operate the lines itself the city concluded to again sell the franchise for a fixed period of time, upon terms more favorable to the people and to the public treasury. The terms of sale required the purchaser to compensate the retiring street railway owners to the amount of the purchase by the city; to pay a rental per mile of $800 per annum for single track and $1,600 per annum for double track, and to pay a percentage upon gross receipts from all sources, as follows: Up to $1,000,000 per annum, 8%; between $1,000,000 and $2,000,000, 15%; upon all gross receipts over $3,000,000 per annum, $20%. The purchaser was further required to replace horse traction by electric power and to build additional lines where and when the city council might direct under the supervision of the city engineer. The city expressly reserved the right to regulate the speed and service necessary and to determine that while the single cash fare should be 5 cts., tickets should be sold in packages at 25 for $1, or 6 for 25 cts. Workingmen's tickets, to be used at stipulated morning and evening hours, were to be sold 8 for 25 cts., and tickets for school children, good between 8 a. m. and 5 p. m., were to be sold at the low rate of 10 for 25 cts. Severe as were these terms, so unusual in the experience of modern street railway magnates, the franchise was sold in September, 1891, and the system is now in complete working order, with the city as the party chiefly benefited, both in the form of a cash return and the greater cheapness and convenience of traffic to its citizens.

This charter, as we understand it, terminates after a period of years and the city has the right to again purchase by determining by arbitration the exact value of all that is necessary for the operation of the system then existing. Meanwhile the city engineer, with the approval of the council, has the authority to prescribe the character of the rails and materials used by the company and in all matters pertaining to paving and the use of the streets the city retains full control. The contract conditions are altogether favorable to the public, while permitting a just return to the operators of the system. It is not necessary to here point out the radical differences between this method of managing lines of public transport and the manipulation of street railway property primarily for the benefit of the shareholders in the lines, or, as is too often the case, for the benefit of the managing officers of the company. The public is already too familiar with the yet prevailing system. The Toronto plan has succeeded in spite of the loud declaration of more or less interested parties that no corporation would even bid for a franchise so hedged in with conditions, and it now remains for other American cities to follow the example laid down. As a rule, street railways are very profitable enterprises, and there is no reason at all why the city should not share in these profits after the traveling public is granted what it should have—the best service at the lowest cost.

LETTERS TO THE EDITOR.

THE EXPANSION OF MASONRY.

Sir: The expansion of masonry is a matter of much importance to engineers, but one which has been somewhat neglected. In a recent discussion, I stated that concrete has the same coefficient of expansion as iron, and my statement was only accepted on account of the high scientific authority which I gave for it. It is only natural that such unfamiliarity with an important property of one building material with which we have to deal every day should be a wide source of failure. The article entitled "Repair of a Reservoir in Colombo, Ceylon," with the accompanying editorial remarks in Engineering News of Aug. 9, are of great value in calling the attention of the profession to this subject; and it is worth while pointing out that provision for contraction and expansion is needed in other masonry than concrete

The accompanying table is rather a novel way of stating the coefficients of expansion of some of the materials in most common use:

Material.	Units of length required to give 1 unit change of length for 180° F. change of temperature.
Sandstone and copper	600
Concrete and steel	800
Slate and cast iron	1,000
Granite and oak	1,200

Of course these equal rates of expansion should not be confused with heat conductivity, a property in which these materials differ widely.

These figures tend to show:

1. That the expansion of concrete (or more properly, of cement) is not exceptionally large, as there are stones with greater coefficients of expansion in general use.

2. That concrete and steel are especially fit to be used together.

3. That the expansion does not depend only on the material itself, but also on the density and the state of aggregation. There is as much difference between steel and cast iron as there is between soft, hard or wet sandstone, or between dumped and rammed concrete.

It is a peculiar fact that mortar of 1 cement to 6 sand shows about the same rate of expansion as pure cement, and concrete also does not differ much from cement in its rate of expansion. It has been suggested in the paper above referred to that brick or stone masonry may endure contraction and expansion better than a monolithic concrete. This is true only to the extent that cracks will be distributed in the joints. The same thing can be observed in walls of artificial stone, while, of course, every crack in a monolithic concrete wall is at once evident, and although this may seem to be a disadvantage, is it not, on the other hand, a real advantage to be able to trace a fault and repair it? All the large masonry walls for water supply built of stone only which I have seen leak more or less, disfiguring their exterior finish. This leakage is attributed to small cracks in the joints which connect somewhere. For an example, take the Gileppe dam in Belgium, which leaks constantly despite its known great margin of strength.

Masonry dams are generally built on a vaulted plan, and therefore having a chance to expand they cannot be

exactly compared with the Colombo reservoir with its straight side 200 ft. in length.

I may refer to a recent discussion on this same subject in the Institute of Engineers, where Professor Forchheimer (Aachen) says that he observed in the Remscheid dam (Westphalia), 460 ft. long, built on a radius of 420 ft., a movement of 2¼ ins. on the crest without injury, and he gives a great number of instances of remarkable injury to straight walls in comparatively mild climates.

As the expansion table above shows, the building material with the greatest expansion is sandstone. We can observe this on all large railings or copings of sandstone—for instance, on bridges. They will have joints open in the winter and will crush the mortar in summer. The simplest way to provide for their expansion

Monolithic Concrete Building in Ulm, Germany; Schobinger & Rehfuss, Builders.

is, if they cannot be built in parts, to insert from time to time an asphalt plate, and to lay them with thin joints in summer and thicker ones in cold weather; otherwise such structures will need pointing every year.

The aqueduct of Vannes, built 20 years ago, which your correspondent (referred to in your editorial of Aug. 16) says has failed from temperature strains, is built of beton "coignet." This beton "coignet," a mixture of lime and cement, has not been used in Europe as a bridge building material for many years. It is now of only historical interest. This mixture does not keep a constant volume, which is not the case with Portland cement concrete, which has taken its place in Europe.

For building bridges of concrete, the constancy of volume is of the greatest importance, but for all concrete work it is very desirable. It may be said here that this property is not of such importance for mortar, mainly because cracks in the joints do not show so much, and can be repaired by pointing.

There is further lack of proper terms for the different kinds of cement; hence any one who is not in a position to investigate for himself may be misled by deceiving names and deceiving expert opinions. This is a work which might well be done by the American Society of Civil Engineers.

The following table of analyses of cements was compiled by Mr. J. Schustler, C. E., of Buda-Pesth, Hungary:

	Natural (Roman) cement.	Portland cement.	Magnesia cement.
Lime	44.96—52.46	58.00—67.00	46.67—51.50
Magnesia	0.50— 3.70	trace— 3.00	5.00—26.05
Manganese oxide	trace— 0.56	.....	.....
Oxide of iron	trace—12.40	2.00— 6.00	1.50— 3.19
Alumina	4.75— 9.80	4.16—10.00	7.32—12.83
Carbonic acid	1.38— 5.58	.....	.....
Phosphoric acid	trace— 0.52	.....	.....
Sulphuric acid	trace— 1.96	0.19— 2.19	0.52— 2.32
Potash	0.25— 0.90	0.19— 2.83	0.42— 0.84
Soda	0.10— 0.78	0.19— 2.83	0.42— 0.84
Silica	11.90—34.07	19.80—26.45	13.63—16.35
Water	0.68— 1.47	.....	.....

Mr. Schustler writes:*

The natural cements (Utica, Rosendale, Louisville, etc.) contain less lime in combination, but a large quantity of free lime, the same as the coignet mixture, while the Portland cement contains more combined lime and little magnesia, which proportion is reversed for the magnesia cements. Natural cements must have time to change their lime to the combined form. They are then weatherproof, but in making this change they have not the constancy of volume which is desirable in cement for concrete, and they are apt to contain over-burned particles which will cause blowing. The most treacherous cements are the magnesia cements. Sometimes, of course, after concrete has been made from such cement, it will swell and disintegrate. The only way to test cements for swelling is to make a chemical analysis or expose to high pressure steam, as recommended by Mr. Erdmenger.

Magnesia cements require a high amount of sand (up to 1 to 5) and can never stand weather well, but if kept constantly below water, they may be safely used.

Those who desire to investigate for themselves can easily do so, as natural cements have been much used in exterior finish. It is the exception when these cements are fit for this kind of work, and this fact has led to a general discredit of cement work for that purpose. Your correspondent has referred to structures in Berlin and Paris. There is no need to go so far away. About New York I would suggest the inspection of the following works: For natural cement, examine the foundation of the Bartholdi Statue of Liberty. Although it is sound, it shows signs of swelling everywhere on the surface, and its appearance is disfigured by the washed-out solution of lime.

For coignet-beton, examine the fountain near the main entrance of Prospect Park, Brooklyn, and a bridge in the Park near the Flower Garden. These structures are made of artificial stones. The exterior finish of most of these stones is perfect; even the most elaborate ornaments are sound. Few places are damaged, and these only show inequality in the manufacture. What mixture was used in casting these ornaments could not be ascertained, but it cannot be far from that general mixture which has been variously designated Coignet, Ransom, etc., and is a mixture of Portland cement and lime.

For American and imported Portland cement, a test of weatherproofness, on a large scale, has been made in Fort Green, Brooklyn, while both American and imported Portland are extensively used for concrete sidewalks. The oldest concrete sidewalks in New York are near the City Hall and there are some more or less distributed all over the city. All these samples which I have mentioned are nearly or quite 20 years old and show for themselves.

A common error which the writer has met with is the attributing failures to contraction and expansion which are really due to other causes. Thus the swelling of concrete, as in the Statue of Liberty pedestal, or the shelling off of the exterior finish of poorly rammed concrete blocks made by dumping, which is caused by freezing water entering through the pores, a property of every soft stone, has been attributed to the expansion of concrete. In dumping concrete, too much water has always been used. This water after draining out or drying up leaves the concrete full of pores. To be weatherproof, concrete requires a dense surface, and if this is not given, as in the concrete sidewalk, for example, and failure occurs, it is the fault of the builder.

Concrete is in many respects a similar material to sandstone, but can be so made as to be free from its objectionable properties. This requires, first, the choice of a good aggregate; second, good cenemt; and, third, good work. So far as cements are concerned, there is a difficulty that no testing laboratories have been established in this country whose tests may be considered as official and a standard in case of litigation.

Before anybody, as, for instance, your correspondent, has a right to generalize from one single case of failure, even if it occurs under his own supervision, he should investigate why the same thing did not happen in a hundred other cases, and he may then find that bad workmanship or poor materials are the real cause of failure. If Dr. Murphy reports that concrete has withstood well the climate of Nova Scotia (Trans. Am. Soc. C. E., 1893, paper No. 625), why should it not stand what your correspondent refers to as the "severe cold" in Berlin, Germany?

The facts are that every masonry wall is more or less cracked. Only in the case of a dam or a reservoir wall is it the engineer's duty to provide such a great surplus of strength that no cracks are likely to occur. I know of hundreds of concrete structures in Germany and have their plans in my office, with official letters expressing the satisfaction of their owners. No damage from weather or expansion is reported. There is quite a number of concerns in Germany which do nothing but concrete construction. In fact, the manufacture of artificial stone has an importance similar to that of the terra cotta industry in this country.

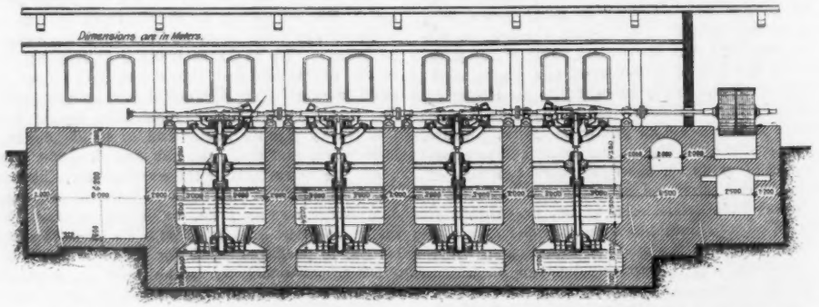
None of these firms could continue to do business and execute works for the Government if concrete really had such defects as are sometimes attributed to it. Most of the concrete bridges in Germany are built on the plans of Government officials. Among the plans in my office is one of a straight concrete wall 10 ft. wide on the bottom and nearly 300 ft. long. This piece of work was built by Mr. P. Amman, for the Kellner, Partington Paper Pulp Co., Hallein (Austria). The firm of P. Amman has used for 18 years for work in its line (water-works, water power, etc.) concrete exclusively. They mix concrete "dry" and lay it in 8-in. layers behind a wooden screen, afterward well ramming it. I have no doubt that this firm, which is one of the best in Central Europe, would have dropped this use of concrete if it were not in accordance with the best practice. Mr. P. Amman states to me, upon special inquiry, that he considers this method of laying concrete the best, as well as the cheapest. Concrete works of such a magnitude as those seen abroad are very scarce in the United States, and will continue to be if such claims of failure as are made by your correspondent are not promptly investigated.

Referring to the Colombo reservoir failure (Eng. News, Aug. 9), let me review some of the main facts: The site declines to the southeast, and the east wall, which has been damaged, will be the one which gets the main share of the heat during the day, while the other walls will remain for the most part in the shade. The temperature of this wall has been stated as up to 159° F. on the outside, the temperature of the water inside being 80°. Calculating the expansion for the coefficient above, this gives for a wall 200 ft. in length a difference of 1½ ins. in length on both sides of the wall. Further, considering the permeability to heat, we see that the upper vault (12 ins. thick) and the upper part of the wall (3 to 5 ft. thick) will be soon heated all through, while in the lower part (15 ft. thick) the heat will never reach the inner side, which is kept cool by the water.

Thus we see that the line of the cracks coincides nearly with the line of greatest tension. Monier built between 1876 and 1886 about 1,000 reservoirs of concrete and iron in France alone. The largest of these are 70 ft. in diameter; most of them are elevated and in a position exposed to the sun, but no failure from temperature strains has been reported, although I know of a failure from the use of bad cement.

I attribute this fact to their circular form, which distributed all force equally, and, second, to the large surplus strength to meet secondary stresses by the use of the combination of concrete with iron, which is able to meet tension and stop cracks.

If we look at the plan of the Colombo reservoir we



CROSS SECTION OF CONCRETE MASONRY FOR WATER POWER PLANT, AT HALLEIN, GERMANY.

* This communication was intended for a discussion of my paper, "Concrete-Iron Highway Bridges," Trans. Am. Soc. C. E., No. 703, but came too late to be included.

see that its square form concentrates the action of expansion and pressure of the wall and vaults on the outside corner, and I do not think that any other masonry, as brick or stone, would have stood the stress any better. It is not explained why a proper reinforcement of the corner was not designed. It might have consisted of simple tension rods, or the wall might have been strengthened at the weak point by buttresses, or better still, rounded corners might have been substituted. All the facts go to show, however, that the designing engineer had no knowledge of the weak point in his structure. Most large reservoirs are built depressed, and it is not explained why the earth cover was not originally intended to protect the sides when the top was protected with a double cover from the start.

It is further to be noted that the reservoir was designed as a retaining wall only. Now, a retaining wall can be cracked without injury to its stability. If we want a wall absolutely secure against leaking, it must have a large surplus of strength. As an example of the reliability of combined concrete and iron, I send you a photograph (not reproduced.—Ed.) showing a gate house at Kosdier, Hungary, where not only the structure itself was made of concrete and iron, but also the five tubes, 150 ft. long, five feet diameter and one foot thick, conveying the water. This is to show that concrete can stand high pressure without a leak, if made strong enough.

To sum up: Expansion should be always considered in masonry work, and where cracks derived from secondary stresses must be avoided, the use of iron rods is to be recommended. The best remedy against all secondary stresses is by avoiding straight walls. Slightly curved walls, or such as can be built in sections, are preferable. Special consideration should be given, however, if a structure is to be subjected to widely different temperatures on opposite sides, as was the case with the Colombo reservoir.

Fr. von Emperger, C. E.

New York, Aug. 16, 1894.

OBSERVATIONS ON EVAPORATION FROM WATER SURFACES IN COLORADO.

Sir: Regarding evaporation from water surfaces, about which inquiry is made in your issue of Aug. 16, I may say that we have carried on at this place (Colorado Agricultural College, Fort Collins, Colo.) observations for the last six years. I have had for the standard tank from which the evaporation has been measured a tank 3 × 3 × 3 ft. placed in the ground. I have also had at intervals as many as four or five small tanks for comparison, and have had during several years tanks floated in lakes and in a neighboring canal and in a river in such manner that they would have nearly the same temperature as the surface of the water in those places, and be exposed to the same conditions. In the case of our principal tank, measurements are made during the season by means of the hook gage, so that the elevation of the surface is read to thousandths of a foot or less. From April or May observations are taken twice daily, at 7 a. m. and 7 p. m. After Sept. 1 the measurements are made but once daily, at 7 a. m., because of the early sunset interfering with the second observation. During the winter, when the water is frozen, the observations are made but once or twice a month, which is then done by completely separating the ice from the sides of the tank, and reading the surface height of the water as in the other observations. At the same time observations are also taken of the temperature of the water surface, temperature and humidity of the air, vapor tension, the movement of the wind, etc. During one season the temperature of the water 1 ft. below the surface was also taken. Allowance is made for rainfall. The observations have not been completely reduced for several years past owing to stress of other work, but from those of 1889 a provisional formula was deduced which gave the amount of evaporation in periods of 12 and 24 hours. This I have not looked upon as entirely satisfactory, as the wind record for the time was not perfect. Nevertheless when this formula was applied to the observations of 1890, the difference between the amount computed by the formula of 1889 and the amount observed by daily hook-gage measurements was less than ¼ in. in a period of about six months. For periods of single days the relative differences were often greater. The data accumulated now is, I think, sufficient to make it more hopeful of securing a formula which will be generally useful, though a careful examination may cause a change of opinion. A set of subsidiary observations is still needed to determine the ratio between the constants of two anemometers which have been in use, one of which has been tested for us by the Weather Bureau, the other of which is nearly worn out.

With regard to evaporation, it may be said, as pointed out by Professor Fuertes, that its determination is more difficult than the determination of rainfall. It may be that this is largely true, because observers have too often expected to find the depth of the layer evaporated from a free water surface nearly the same throughout a given region, and that the differences would be greater than are found with rainfall. It cannot be emphasized too much, that evaporation is almost entirely a local phenomenon. The amount depends almost entirely on the conditions at that special point. It depends not only on the moistness of the air, which may be fairly uniform over considerable areas, but particularly on the rapidity of the wind at the water surface or near by, which serves to remove the saturated air, and the temperature of the water surface itself. These will vary according to the exposure, and the temperature will vary according to the amount of water, its surroundings, the depth and many other conditions, so that the difference of temperature in different bodies of water in the same locality is often considerable. It is the temperature at the surface itself rather than of the body of water, which determines the rate, because the phenomenon is a surface one. It does not require any great difference of temperature to make a marked difference in the rate of evaporation. Thus, in the course of a single month, the evaporation from a neighboring reservoir was at twice the rate of evaporation from our tank placed in the ground. The difference was almost entirely due to the warmer temperature of the water in the reservoir, and though this was but 10°, it was sufficient to account for the double rate, as shown by application of our formula. It is because of the varying temperature of each separate exposure that the evaporation is so variant even in the same locality. Accordingly the observations taken under one set of conditions will give results which may be very misleading if applied to other conditions, unless the effect of each element which enters can be allowed for. In any series of observations on evaporation I deem it very important that the temperature of the surface of the water be taken. Another thing which makes it difficult to obtain a formula representing the evaporation, is that the evaporation does not depend upon the average temperature of the water as compared with the average moisture of the air, but is the sum of the effects of the differences instant by instant.

In the case of a large body of water, the temperature of the surface does not vary materially during the 24 hours. With a smaller body, like our 3-ft. tank, hourly observations carried on through the 24 hours show that the temperature increases with comparative rapidity during the forenoon, but decreases very slowly during the afternoon and night. In the heating, the warm water remains at the top, while the whole mass shares in the cooling. There are often times, however, when the warm water is at the bottom, if the water has remained undisturbed. With a small mass of water, as in the Piche evaporometer, the temperature of the water cannot differ much from that of the air, or of a wet bulb thermometer. The results shown by this instrument would seem, therefore, to be rather an integration of the differences of vapor tension between the tensions corresponding to the temperature of the dew point and of the air. While the results between different Piche instruments may be comparable, as the exposures are under similar conditions, I do not think that they can give very valuable indications as to the actual amount of evaporation from a free surface. The temperature of the water in reservoirs, in summer, may be quite above that of the atmosphere. A comparison of the results given by a Piche and a tank at the Sweetwater reservoir, California, quoted in the Weather Review for November, 1890, shows that the measured evaporation in the summer months was nearly twice that shown by the Piche instrument.

To some extent the same objection holds true of the Richards evaporation gage, one of which we had here, but have used principally for other observations.

The evaporations at this place have been reported but partially, and not since the annual reports of the Experiment Station for 1890 and 1891.

Most of the observations on evaporation, of which there are many reported in various places, are not very valuable because the conditions of the observations have not been sufficiently given. FitzGerald's excellent observations, the best as a whole with which I am acquainted, gave him the conditions for determining a formula for computing the evaporation. The formula was based, however, on hourly observations, which are generally impracticable under the conditions to which engineers are subject. Some very good isolated observations on the lakes and rivers of California are reported by Mr. J. D. Schuyler in the report of the State Engineer of California for 1878-9, which may be mentioned because of the geographical location of your correspondent. Very truly yours, L. G. Carpenter.

Professor of Engineering, Colorado Agricultural College.

Fort Collins, Colo., Aug. 25, 1894.

(The long period over which the above evaporation observations have extended and the evident care with which they have been made renders it very desirable that the results should be fully tabulated and published, both for local benefit and for the good of the engineering profession at large.—Ed.)

AN OVERLOOKED STAND-PIPE FAILURE.

Sir: While on a recent irrigation trip through the Arkansas Valley I accidentally came upon the Dodge City stand-pipe, which was wrecked July 1, 1893. Its failure, as far as I can learn, has not been reported to any engineering journal.

This stand-pipe was built in 1885, by Palmer & Son, Kansas City, Mo. It was located about one mile north of the river, on a hill, the foundation being 130 ft. above the river. It was 12 ft. in diameter and 100 ft. in height, resting on a sandstone foundation extending 2½ ft. above the ground. The plates were of iron, ⅛ in. in thickness at the bottom and ¼ in. at the top, horizontal joints being single riveted, the vertical joints double riveted; the rivets were ¾ in. in diameter. There were six ¾-in. iron guy rods attached to the pipe 75 ft. from the foundation and connected to masses of masonry 90 ft. distant from the foundation. Two of these were at the northeast point, two at the southeast, one at the northwest and one at the southwest point. There were also in addition to these two wire guys added five years after erection, one at the northeast, the other at the southeast point. There were stiffening angles at both the top and bottom of the pipe.

The pipe leaned a little to the west, the two west guy rods being slack, while the four on the east side were taut. It was to correct or prevent further leaning that the two wire guys were added. The leaning was caused by the settling of the foundation on the west side. The opening for flushing, which was on the west side, leaked, saturating the ground on that side. It is not known when it began to leak. The pipe is said to have been full of water at the time it failed.

The maximum velocity of the wind for a five-minute period at Dodge City, on the day of the failure, was 60 miles per hour, as recorded in the U. S. weather station there. The direction of the wind at the time of this maximum velocity was north and northeast, and it was a straight gust, no whirling. The foundation of the pipe being at a greater elevation than the station the velocity of the wind at the pipe must have been greater than 60 miles per hour.

The northwest guy rod broke 5 ft. from its anchor, at its union with the link; one of the northeast guy rods broke 20 ft. from its anchor at a link; the wire rope fastening at the top of the pipe failed.

The pipe failed in four places: (1) At the base, the first course tearing away from the bottom, leaving the latter in place; (2) between the 6th and 7th courses; (3) between the 11th and 12th courses; (4) a nearly vertical break between the 7th and 11th courses.

The pipe fell in a direction approximately south, the lower end now being at a distance of 12 ft. from the foundation.

I am indebted to Mr. F. A. Etrick, of Dodge City, for some of the facts here presented.

E. C. Murphy,

Asst. Prof. of C. E., University of Kansas.

Lawrence, Kan., Sept. 12, 1894.

THE INTERNATIONAL WATERWAYS CONVENTION AT TORONTO.

The International Deep Waterways Convention was opened at Toronto on Sept. 16, with a number of delegates present representing the commercial interests of the United States and Canada on the lakes. Mr. Enoch Thompson, of Toronto, in discussing the question of who should pay for the proposed improvement to a 20-ft. navigable channel to the sea, said that Canada, with 3,000,000 directly interested, had expended $50,000,000, while the United States, with a population of 26,000,000 bordering on the lakes, had spent only $8,000,000 in the improvement of waterways used on equal terms by both countries. As to the expediency of the improvement of existing channels, he said that in seven months of 1893 30,000,000 tons of freight were transported on the lakes, an amount equivalent to over one-fourth of all the freight carried yearly on railways in the United States. Based on an estimate made by Mr. Corthell, the cost of the deepening of channels, from Duluth to the sea would be $64,750,000. He said that while the best practicable route lay through Canadian territory, Canadian business alone did not justify that country in expending the necessary money. He suggested that it would be to the interest of the American lake cities to enter into the project.

Mr. L. E. Cooley, of Chicago, favored a 25-ft. channel as a minimum, and claimed that by reason of recent and important improvements in canal excavation, the cost would not be prohibitory. As to route, he did not approve of the Georgian Bay project, and in illustrating the effect of canals in reducing speed, said that the proposed canal across Michigan, from Chicago to Toledo, would be 180

miles long, and would cost $750,000 per mile; yet a propeller could start from Chicago and run around to Toledo in present channels in less time than it could traverse such a canal. He felt obliged to enter Lake Ontario in any theory of a canal to tidewater. But he considered that the best route out of that lake for domestic trade was by the Mohawk Valley or Lake Champlain, with the latter providing a longer route, but one with deeper water and permitting greater speed as a consequence. In 50 years from now he believed the canal traffic over such a route would amount to 50,000,000 tons per year.

Mr. Cooley estimated the cost of deepening the St. Lawrence canals at $27,000,000, and put the cost of a new canal, on the American side of Niagara, at $23,000,000. The 20-ft. channel from Lake Champlain to New York would cost $50,000,000, so that he thought that a complete system involving the two branches could be built for about $100,000,000. He said the Welland Canal had three times as many locks as it ought to have, and that it would be better to build a new canal from Erie to Ontario rather than to improve the Welland. The total lift from lake to lake was 326 ft., and to overcome this 25 locks were used. The French now build locks 21 ft. wide and 39 ft. lift, and he thought 40 ft. lifts should be used on this route. The Lake Champlain route would save 1,000 miles to the West Indies for Montreal commerce, and he estimated $1.00 as the rate per ton on canal freight from Duluth to New York, as compared with $4.80 per ton by rail. In answer to a question Mr. Cooley said there was now 20 ft. of water in the Hudson River to within 30 miles of Albany.

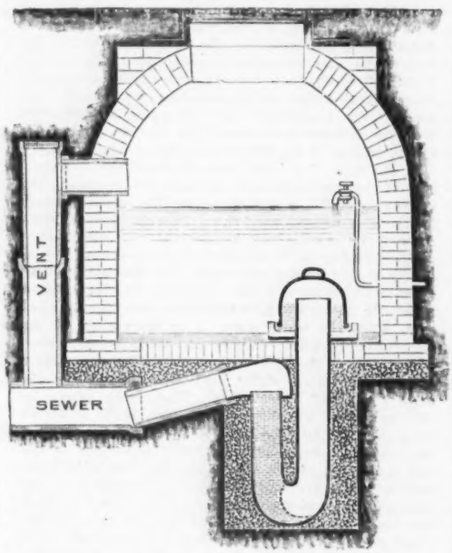
Mr. O. A. Howland, member of Parliament for Toronto, discussed the question of treaty rights, and said the navigation of the St. Lawrence was made free to the United States by the treaty of 1783. By later treaties the Canadian government gave to the people of the United States the use of Canadian canals on equal terms, subject to the Canadian laws governing navigation. In return for this privilege the United States gave like rights to the Canadians for government canals, and undertook to urge upon the various states the propriety of also making state canals free to them. The United States has carried out this plan so far as its own canals are concerned, but that part of the compact relating to state canals is unperformed. After referring to the several recent toll entanglements between the United States and Canada, Mr. Howland proposed that with the recommendation of a project for deepening the canals the convention should recommend the establishment of an international high court that would make war between the two countries forever as impossible as war between the various states of the Union.

Mr. James Suydam, of St. Paul, in a speech, advocated the Lake Superior and Mississippi Canal project, and attempted to point out the advantage to the people of the great Northwest of sending their products to the sea by way of the Mississippi River. Mr. E. A. Macdonald also spoke on the Hurontario Canal, which he prophesied would be completed by 1898. His chief argument seemed to be that if freight once got into Lake Erie it was sure to go to New York, while the Georgian Bay channel would guarantee this freight to the St. Lawrence route.

The "Toronto Globe," in commenting upon Mr. Cooley's proposed route by way of Lake Champlain to the Hudson River and New York, reminds its readers of an interview with Mr. Chauncey N. Dutton, of Pittsburg, Pa., published some time ago in that journal. Mr. Dutton, in promoting the North American Canal Co.'s project, also included the deepening of the Champlain route. He dwelt upon the relative importance of the domestic trade, as contrasted with the foreign trade, and said his object was to reach the great cities of the East, including New York and the teeming population of which it was the center of distribution. He pointed out the fact that in 1892 the railways of the United States moved 704,348,609 tons of freight an average distance of only 115 miles, and said that the total domestic freight movement of the United States and Canada was about 950,000,000 tons annually, as compared with a foreign trade of about 30,800,000 tons. The "Globe," however, says that as freight must go to Montreal to enter the Champlain Canal, and as the people of the West look to Europe as the chief market for their surplus products, the bulk of the freight reaching Montreal would be likely to pass right on down the St. Lawrence. The deepening of the Champlain route requires also the deepening of the St. Lawrence canals, and to make an entirely American waterway around Niagara and to the Hudson on the line of the Mohawk River entails so long a canal route and so many delays that it would be too expensive. For these reasons the "Globe" contends that the St. Lawrence outclasses all its rivals in directness and facilities for transit. As to the question of American financial interest in a canal enterprise wholly on Canadian soil, the "Globe" says that as Americans, under present arrangements, would equally share all the benefits, there is no just reason why they should not share in the cost of the undertaking.

THE MILLER AUTOMATIC FLUSH TANK FOR SEWERS.

We illustrate herewith an automatic flush tank for sewers, which is being manufactured by the Pacific Flush Tank Co., of Chicago, Ill., and which is claimed to be especially simple in construction and reliable in operation. The essential feature of this tank is the Miller automatic siphon, through which the water is discharged into the sewer and which gives the tank its automatic action. The frequency with which the discharges take place is determined by the rate at which the water is admitted to the tank.



The Miller Automatic Flush Tank for Sewers.

The construction of the tank is clearly shown by the drawing. The long leg of the siphon extends up through the bottom of the tank and is covered by a cast iron bell, underneath the bottom of which the water is admitted to the siphon. The short leg of the siphon connects with the sewer to be flushed. The trap is, of course, filled with water. As the water entering the tank rises above the lower edge of the bell, it incloses the air within, and gradually compresses it as the water level becomes higher in the tank. The compressed air gradually forces the water out of the long leg of the siphon. Now, as the difference of level of the water in the two legs of the siphon is the same as the difference in levels between the water in the tank and the water within the bell, it will be seen that the column of water in the discharge leg of the siphon has practically the same depth as the water in the tank, less the height of the water in the bell. The two columns of water, therefore, balance each other at a certain depth of water in the tank. As soon as this depth is increased by the inflow from the pipe, a portion of the confined volume of air is forced around the bend of the siphon and in its sudden escape up through the short leg, it carries out with it a portion of the water in that leg. This destroys the equilibrium between the two columns of water, and the water in the tank, in its effort to restore the equilibrium, rushes into the siphon, filling it and setting it in action. This flow continues until the water in the tank is drawn down below the bottom of the bell. The water then begins to rise again in the tank and the flushing is thus repeated at regular intervals.

The tank is built of brick and the diameter required varies from 4 ft. to 5½ ft. for sewers from 6 ins. to 15 ins. in diameter. The siphon and bell are cast iron, and the diameter of discharge required for sewers of the above dimensions is from 5 ins. to 8 ins. The discharge for a 5-in. siphon is at the rate of 6 gallons per second and for an 8-in. siphon, 20 gallons per second. The cost per tank complete varies of course with the cost of brick and labor in different localities. Estimates recently made at Peoria, Ill., for a 4½-ft. tank and 6-in. siphon showed the cost to be from $60 to $70. This tank is in use in a large number of Western cities and towns and is stated to have given unusual satisfaction in its operation.

CAR FENDERS FOR BALTIMORE STREET RAILWAYS.

In a recent report by Mr. Mendes Cohen, Past President Am. Soc. C. E., engineer of the commission appointed to select a form of car fender suitable for use on electric and cable railways in the city of Baltimore, the results of the investigations which have been carried on by the commission for nearly a year are made public. The following is an abstract of the more important features of this report.

The conditions which a fender suitable to cars used on Baltimore street car lines had to meet were variable. Both electric and cable cars are used, some lines running single cars, others trains of cars, and still others varying their practice between these two systems. The cars used vary in length from 19 ft. 10 ins. to 30 ft. 4 ins., and are mounted, some on two short swiveling trucks and others on single trucks of long wheel base. The distance from the front end of the car to the center of the front wheels varies from 3 ft. 8 ins. to 10 ft. 3 ins., and the speed at which the cars are run varies from 6 miles to 20 miles per hour.

About 70 different fenders were submitted for examination. These Mr. Cohen classifies in four groups, based on their forms or modes of operation, as follows: (1) Combination fenders, which include in one design a projecting front fender and a wheel guard; (2) front scoop or pick-up fenders, designed to catch or pick up persons standing or lying on the track, but with no supplementary wheel guard; (3) front platform fenders designed to trip a person standing on the track and cause him to fall onto the fender, but with no wheel guard, and (4) wheel-guard fenders, with or without scoops, intended to protect persons whom the front fender has failed to save from being crushed by the wheels.

Mr. Cohen holds that simplicity in a fender is highly important. A proper equipment of a car with safety appliances would require the front surface of a car to be so arranged, (1) to afford a reasonable prospect of saving a person struck from being dashed to the ground; (2) to cause the least possible danger of injuries by its own impact; (3) if the person does fall to the ground, to pass over him without doing further injury, and (4) to prevent the crushing of a victim, after the front fender has passed over him, by the use of a wheel guard, preferably of angular or "pilot" form, which is automatically brought close to the surface of the ground in case the front fender passes over an obstruction.

A combination front fender and wheel guard is thus advised by the report. It is also considered desirable that the front fender should be so constructed as to fold up against the front of the car when not in use. Five fenders of the number examined are named as satisfying these conditions after some modifications. We hope to give a brief description of these fenders in a future issue. Several forms of fenders in use in other cities were described in our issue of March 8, 1894.

Three triple-expansion sewage pumping engines of 36,000,000 gallons daily capacity each are to be built for the city of Providence by the Holly Mfg. Co., of Lockport, N. Y. The pumps will work against an average head of 27 ft., raising the sewage from the sewer in Allen Ave. to the outfall sewer in Ernest St. The work is to be completed by June 1, 1895. The Holly Co. will also furnish four Babcock & Wilcox boilers for the plant, the contract price for the whole work being $100,000, according to the Providence "Telegram."

Plans for a bridge across the Delaware River, at Philadelphia, have been approved by the Secretary of War. The bridge is to be built by the Pennsylvania R. R. Co. and will cross the river about one-fourth mile due east of the lines of this company at Frankford Junction, and will touch the New Jersey shore at the Fish House. The original plan calls for 500-ft. spans, but these will probably be longer. A 300-ft. draw-span is provided for, and a distance of 40 ft. is required between high water and the bottom of the bridge. The alleged purpose of the bridge is to facilitate the handling of freight, and generally improve facilities for traffic with that part of New Jersey north of Camden.

Out of the 300,000 shares of Panama Canal stock offered in Paris by the promoters of the new scheme, "Le Soir" says that only 40,000 shares were subscribed for in Paris, and about the same in the provinces. The shares were offered at 100 francs, or $20 each.

The New York & New Jersey Bridge Co., at its recent annual meeting, elected the following board of directors: John B. Kerr, Vice-President New York, Ontario & Western R. R., New York; Louis Windmuller, Director Title Guarantee & Trust Co., New York; Charles A. Smylie, merchant, New York; Frederick Potter, Potter Building, New York; Wm. Bell, Produce Exchange, New York; Wm. H. Ely, leather merchant, New York; Lorenzo Duncan, merchant, New York; John Loughran, President Manufacturers' Bank, Brooklyn, N. Y.; Charles H. Swan, Treasurer N. Y. & N. J. Bridge Co., Brooklyn, N. Y.; Daniel N. Lockwood, Buffalo, N. Y.; Gen. Jas. S. Clarkson, Des Moines, Ia.; John S. Runnells, General Counsel Pullman Co., Chicago, Ill.; John C. Adams, President Gas Co., Newburgh, N. Y. The officers agreed upon are: President, John B. Kerr; vice-president, Louis Windmuller; secretary and treasurer, Charles H. Swan. At this meeting Secretary Swan presented a report, setting forth that the 2,000-ft. cantilever plan for a bridge over the Hudson, as proposed by this company, was the only feasible and practicable one to be adopted, both from an engineering and a financial standpoint.

The contract for the Baltimore electrical subways, the specifications for which were published in our issue of Aug. 23, has been awarded to the White-Crosby Co., of Baltimore, which is to lay 3-in. terra-cotta ducts, of the Camp pattern, its price for the entire work being $63,487. Among the other bids was that of David E. Evans & Co., who bid $54,718 for terra-cotta conduits of the Lynch pattern. The ducts in this system are molded in pairs or fours, instead of singly, and in longer sections than the Camp ducts; the engineer, therefore, favored the Camp duct in his report. The lowest bidder for other types of conduits was the McKay-Howard Engineering Co., which submitted bids as follows: Treated wrought iron conduits, $81,306; creosoted wood, $57,357; cement-lined pipe, $68,300.

The Providence (R. I.) City Council has appropriated $2,500 for making experiments upon artesian wells as a means of securing a pure water supply for the city. The report of City Engineer Shedd, the substance of which was given in our issue of Sept. 13, p. 203, appears not to have convinced the city fathers that it was not possible to extract blood from a turnip.

A convention to secure a system of drainage for the Texas coast region is to be held at Galveston, Tex., on Oct. 3 and 4. Mr. C. H. McMaster, of Galveston, is secretary of the organization which has the matter in charge.

A plant for rolling tubes by the Mannesmann process is to be built in the United States by a company whose chief backer is Col. Albert A. Pope, President of the Pope Manufacturing Co., of Hartford, Conn. Colonel Pope has organized the Pope-Mannesmann Co., with a capital of $750,000, and the works for rolling the steel tubes will be erected at Hartford, adjoining the bicycle works of his company. The output will be bicycle-tubing and seamless locomotive boiler tubes, up to 2 ins. in diameter. Last year 1,500,000 lin. ft. of Mannesmann tubing for bicycles was imported. An establishment for making copper and brass tubes, under the Mannesmann patent, up to 10 ins. diameter, is being put up at Waterbury, Conn., by Benedict & Burnham. They have been at work upon it for four months past, and expect to have it in full working order by Oct. 5.

A plan for remodeling the present county buildings in Chicago has been presented to the County Board by Messrs. Hill & Woltersdorf, architects. The remodeled building would cost $1,750,000, and the firm of V. Falkenau & Bro. submit a proposition to do the work. The architects report that the main defects in the existing building are bad lighting, inferior and unsanitary plumbing, inadequate elevator service and crumbling stone in the upper story. They say no settlement of the walls has taken place in many years, and they now propose to remove the inferior walls of the upper story and rebuild two new stories without increasing the height above the legal limit; and also to correct all the defects pointed out in their report. The Illinois Chapter of the American Institute of Architects suggests the Lake-front as a suitable site for new public buildings for Chicago, combined with art museums, public institutions and parks in such manner as to surpass in effect the famous Court of Honor at the Chicago Exposition.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago—Existing Roads.

BEAVER & ELLWOOD.—Allison Bros., New York, are reported to have been awarded the contract for extending this railway from South Ellwood City to North Sewickley, Pa., to develop coal lands and limestone quarries. The present line of the road is only three miles in length and was built in 1890.

CLEARFIELD, CONEMAUGH & WESTERN.—Samuel Brugger, Flemington, Ch. Engr., has completed the surveys for this railway from a connection with the Beech Creek road above Belsena, Pa., to Johnstown, and it is expected that a contract for building the road will soon be awarded. Pres., S. J. M. McConnell, Harrisburg, Pa.

TOLEDO, ANN ARBOR & NORTH MICHIGAN.—Contracts have been let for constructing 2½ miles of the new terminal line of this road into Toledo, O., to O. H. Breyman & Co., Toledo. A contract has also been let to G. D. Weiever for a new line from Clarence to Temple, Mich., 4½ miles. The Detroit Bridge & Iron Co. has been awarded contracts for two bridges over the Shiawassee River at Vernon, Mich. Ch. Engr., H. E. Riggs, Toledo, O.

Projects and Surveys.

MUNCIE & NEW CORNER.—A company is reported as being formed at Muncie, Ind., to build a railway from Muncie to New Corner, a distance of 12 miles. The steam motors formerly used by the Muncie St. Ry. will be used. Box, flat and stock cars will be built, and the track will be standard gage. It will be a small link in the much-surveyed air line route from Cincinnati to Chicago, which could be had by building track from Hagerstown to Marion. The large street cars will be used for coaches. F. G. Brownell is at the head of the project.

SOUTH SHORE.—Monroe, Strang, Lee & Co., 15 Wall St., New York, have shipped two steamers loaded with contractor's outfit, together with some 300 men, to Yarmouth, N. S., where the firm has the contract for constructing this projected railway.

Southern—Existing Roads.

DRY FORK.—Press reports state that it is the intention to open this line about Oct. 1. It runs from Hendricks, W. Va., on the West Virginia Central, to Wharton, a distance of 35 miles, in Randolph county. It follows the Dry Fork of Cheat River for about 32 miles to the confluence of the Gaudy and Dry Forks; thence it follows the Gaudy to the Allegheny divide, or 15 miles south of its present terminus.

FARMVILLE & POWHATAN.—It is reported that this narrow gage railway will be extended from Farmville, Va., into Prince Edward county and that a part of the extension is already graded.

FLORIDA SOUTHERN.—A five-mile extension of this road will be completed by Nov. 1 and it is stated that an additional extension is contemplated.

JACKSON.—The construction of this railway from Jackson to McManus, La., on the Yazoo & Mississippi Valley, has been commenced, the work to be completed Feb. 1, 1895. Pres., F. Herr, New Orleans, La.

MONTGOMERY, HAYNEVILLE & CAMDEN.—No contracts have yet been awarded for the proposed work on this railway, noted Aug. 16, according to reports. It is intended to complete the first 20 miles before Dec. 1 and the entire 73 miles as soon as possible. The work will require four large steel bridges. Pres., S. D. Bloch, Camden, Ala.

VALDOSTA SOUTHERN.—About 10 miles of this railway has been completed. The line is projected to Deadman's Bay, Fla. Pres., J. M. Wilkinson, Valdosta, Ga.

Projects and Surveys.

BIG LAWREE & PANTHER CREEK.—Incorporated in West Virginia to build a railway from the mouth of Cherry River, Nichols county, to the headwaters of Panther Creek, Greenbrier county. Fifty thousand dollars is subscribed. The stock is held by W. G. Gartner, O. C. Gartner, J. M. Boyer, of Selins Grove, Pa.; J. L. Miller, of Sunbury, Pa., and Thomas Carson, of Alexandria, Va.

ORANGE & MADISON.—J. B. Walker, Luray, Va., is reported as making surveys for a proposed railway from Orange to Madison, Va.

SANFORD & LILLINGTON.—Mr. Strange, Fayetteville, N. C., is reported as making surveys for a railway from Sanford, in Moore county, through Harnett county to Lillington, N. C.

SOUTH CAROLINA.—This company is being organized at Aiken, S. C., according to reports, to build a railway from Charleston through Berkely, Barnwell and Aiken to the Savannah River.

SOUTHERN R. R. & STEAMSHIP.—This company is reported as being organized by J. M. Mayo and J. H. Curry, Ocala, Fla., to build a railway from Palatka to Tampa, Fla., 140 miles.

Northwest—Existing Roads.

CHICAGO, PADUCAH & MEMPHIS.—The formal opening of this railway between Mount Vernon and Marion, Ill., was announced for Sept. 25. Gen. Man., B. F. Johnston, St. Elmo, Ill.

CHICAGO, IOWA & DAKOTA.—It is stated that new steel rails will be laid on the entire line of this railway, 26½ miles in length, new bridges built and the road thoroughly ballasted, and that machine shops will be built at Eldora, Ia. C. Miller, the newly elected president, hopes to have the road extended into Northern Iowa in the spring.

Southwest—Projects and Surveys.

ARKANSAS CENTRAL CONSTRUCTION CO.—Incorporated with a capital stock of $500,000 to build and operate railways; Pres., P. C. Ewing; Vice-Pres. and Treas., Zeb Ward; Secy., Howell Jordan; directors, R. E. Brugman and Zeb Ward, Jr.

EL PASO NORTHERN.—Incorporated in Texas to build a railway from El Paso along the right of way granted by El Paso to the Kansas City, El Paso & Mexican R.R.Co., in 1888, thence northeasterly through the county of El Paso about 20 miles more or less, to a point on the division line between New Mexico and Texas; directors, C. E. Satterlee, G. J. Gould, W. H. Abrams, C. R. Morehead, L. S. Thorne and E. L. Sargent. When the Kansas City, El Paso & Mexican R. R. Co., which started to build a line to Albuquerque in 1888, became bankrupt, its property was purchased by Jay Gould, as president of the Texas & Pacific.

SAN ANTONIO, BROWNSVILLE & MEXICAN.—S. Massey, San Antonio, Tex., writes as follows to the "Manufacturers' Record," regarding this proposed railway: We propose to build the San Antonio, Brownsville & Mexican Ry., and will organize the company at once. We intend to get our charter, make final surveys from the city of San Antonio to Brownsville, Tex., some 300 miles, to make profile, maps, prospectus, and all proper data required to place our bonds. We will build first from San Antonio to Pleasanton, some 30 miles, to put the road on a bonding basis. Should we find the money market, when we are ready to dispose of our bonds, in such conditions that we could cross the Rio Grande River into Mexico, and enter the rich coffee and fruit lands of that country, we will do so; if not, we shall build to Brownsville and wait better times. Between San Antonio and Brownsville our line will run through some of the finest country in the state of Texas and some of the largest cattle ranches in the world.

SPRINGFIELD & HARRISON.—Press reports from Springfield, Mo., state that surveys were commenced Sept. 21 for a railway from that city to Harrison, Ark., and that the right of way for nearly the entire distance has been guaranteed and financial aid offered by Boone county, Ark.

Rocky Mt. & Pacific—Projects and Surveys.

SAN JOSE.—Incorporated at San Jose, Cal., to build a railway 19½ miles in length in San Jose and Santa Clara counties, any modern motive power to be used; capital stock, $1,000,000; incorporators, Wendell Easton, Moses L. Levy, Chas. M. McKeeney, San Francisco; James W. Findley, Eugene M. Rosenthal, San Jose.

STREET AND ELECTRIC RAILWAYS.

BUCKFIELD, ME.—The construction of an electric railway from this place to West Paris, passing through North Buckfield, West Sumner and North Paris, is being discussed. It is the intention of the projectors to carry passengers, mail and freight.

BENNINGTON, VT.—The extension of the electric railway already built from Hoosick Falls, N. Y., to Wallomsack, to this village, is being agitated. E. L. Sibley and E. E. Larrabee are interested.

BLANDFORD, MASS.—The construction of an electric railway between this place and Russell is being discussed, and surveys are about to be made.

NEWPORT, R. I.—It is reported that negotiations are being made for the purchase of the Newport St. Ry. by the company that operates the Fall River road, which will probably extend and improve the line.

ALBANY, N. Y.—The state board of railroad commissioners has granted franchises to the Syracuse St. R. R. Co. and the Canandaigna St. Ry. Co. to change the motive power to electricity, and to the Fort Plain & Richmond Springs Ry. Co. to increase its capital stock from $300,000 to $600,000.

LONG ISLAND CITY, N. Y.—The Newtown Ry. Co. has been incorporated to construct a street railway from this city to Flushing; capital stock, $150,000; directors, R. T. McCabe, W. A. Pease, New York; C. M. Meyer, Maspeth, N. Y.; George Chambers, Long Island City; R. C. Pruyn, Albany.

SOUTH ORANGE, N. J.—The New York Standard Construction Co. has petitioned for a franchise for an electric railway.

OLD FORGE, N. Y.—The Old Forge R. R. Co. has been incorporated to construct a street railway from the Fulton Chain station to this place, a distance of two miles; capital stock, $20,000; directors, J. F. Luther, Utica; D. M. Hall, Booneville, and others.

MINERSVILLE, PA.—The New Castle, Minersville & Tremont St. Ry. Co. has been incorporated with a capital stock of $100,000 to construct a line 12 miles in length. Pres., W. F. Sadler, Carlisle.

NEW HOLLAND, PA.—The Pennsylvania Traction Co. will soon commence the construction of an electric railway from Lancaster to this city, a distance of 15 miles. It is reported that the line will be extended to Terre Hill.

PHILADELPHIA, PA.—The Philadelphia Suburban Passenger Ry. Co. has been incorporated with a capital stock of $600,000 to build 90 miles of street railway in the northern part of the city. Pres., G. D. Widener, 1202 North St.

PITTSBURG, PA.—The Highland Park & Butler St. Ry. Co. has been incorporated with a capital stock of $12,000; Pres., H. S. A. Stewart; J. J. Donnell, J. G. Holmes.

POTTSTOWN, PA.—The Ringing Rocks Electric Ry. Co. has been granted a franchise to extend its line to Gilbertsville, Boyerstown and New Berlinville, a distance of seven miles.

BALTIMORE, MD.—It is reported that the contract for constructing an electric railway between this city and Washington will soon be awarded.

BENWOOD, W. VA.—The contract for building the Benwood & Southern Electric Ry. from this place to Moundsville, a distance of 15 miles, has been awarded to Wareham & Hughes, Beaver Falls, Pa., at $200,000.

PARKERSBURG, W. VA.—It is reported that a contract has been awarded for the construction of an electric street railway.

ST. AUGUSTINE, FLA.—The St. Augustine Electric Ry. Co., recently incorporated with a capital stock of $150,000, will soon commence the construction of its proposed road.

NEW ORLEANS, LA.—The Orleans St. Ry. Co. is making arrangements to equip its line for using electricity, at an estimated cost of $275,000.——Surveys are being made for the rearrangement of the tracks of the St. Charles St. Ry. for electric motors. Bids will be called for as soon as the surveys are completed.——The Canal & Claiborne St. Ry. Co. are discussing the equipping of its line with electricity.

CHATTANOOGA, TENN.—It is reported that steps are being taken to construct an electric railway to the summit of Walden's Ridge, 1,800 ft. high and ten miles from this city.

COLUMBUS, O.—The contract for constructing 17 miles of electric railway will be soon awarded by the Columbus Ry. Co. Pres., J. F. Flournoy.

MOUNT VERNON, O.—The Central Ohio Electric Ry. Co. has been incorporated to construct a line through central Ohio, the first section to be constructed from this city to Marion; capital stock, $100,000; Pres., F. W. Jones; Treas., W. M. Koons; Secy., J. A. Caldwell.

SPRINGFIELD, O.—It is reported that Fred Colburn, Charleston, W. Va., and J. G. Webb, Springfield, are interested in a proposed electric railway from this city to Urbana, passing through New Moorfield.

BATTLE CREEK, MICH.—A franchise has been granted to L. N. Downs, New York; F. N. Rowley and E. E. Downs, Kalamazoo, to construct an electric railway.

MORENCI, MICH.—The construction of an electric railway from this place, to connect with Toledo and Pioneer, O., is being discussed. C. G. Hinkle, Lyons, and Horace Tredway, Metamora, are interested.

COLLINSVILLE, ILL.—It is stated that arrangements are being made for an electric railway from St. Louis to this place, for which $65,000 has now been secured.

SIOUX CITY, IA.—The promoters of the proposed electric railway between this city and Dakota City, Neb., are to petition the councils of the two cities to vote a tax to aid the project, which includes the construction of a pontoon bridge across the Missouri River.

SALINA, KAN.—L. M. Erb, Leavenworth, has been granted a franchise to build an electric railway five miles long in this city. The citizens give as a bonus $30,000 in real estate and $500 cash. Work will be commenced inside of 30 days.

WEBB CITY, MO.—The Southwest Missouri Electric Ry. Co. is making arrangements to extend its line to Carthage, a distance of 12 miles.

FORT WORTH, TEX.—The Glenwood & Polytechnic College St. Ry. Co. has been incorporated with a capital stock of $100,000; R. Vickery, Waxahachie, and George Tandy, Fort Worth.

HAMILTON, ONT.—The granting of a franchise for an electric railway between this city and Brantford is being discussed by the council.

HALIFAX, N. S.—The St. Henry Chemical Co. is making arrangements to utilize a waterfall near Waverley, ten miles from this city, for generating electricity for an electric railway in this city. Two dams have already been built. B. C. Wilson is interested.

ELEVATED RAILWAYS.

CHICAGO, ILL.—It is stated that a contract has been signed by D. H. Louderbach and the Phoenix Bridge Co. whereby the latter is to extend the double track structure of the Lake St. elevated railway from the present terminus to the east line of Wabash Ave., along Lake St. Ornamental stations will be constructed at Fifth Ave., Clark and State Sts. Another improvement contemplated as soon as the new power house of the West Chicago St. Ry. Co. is completed, is the substitution of electric motors on the Lake St. line for the locomotive engines now in use.

HIGHWAYS.

MASSACHUSETTS.—The state highway commission has voted to build nine roads, estimated to cost about $60,000.

MONTANA.—Bids are asked until Oct. 12 for grading 6,500 lin. ft. of highway in Prickly Pear canyon. The work includes 4,500 cu. yds. of earth excavation, 125 cu. yds. of slate or solid rock excavation and four 5 × 6-ft. culverts. J. S. Tooker, Clk., Helena.

BRIDGES.

FAIRFIELD, ME.—At a town meeting Sept. 22 it was voted to build an $8,000 bridge.

PHILADELPHIA, PA.—It is reported that J. T. Richards, Engr. Maintenance of Way, Pennsylvania R. R., is receiving bids for the construction of a five-pier stone bridge on the Columbia & Port Deposit branch across Conestoga Creek at Sag Harbor.

BALTIMORE, MD.—The contract for the construction of the Columbia Ave. bridge over Gwynn's Falls has been awarded to the Youngstown Bridge Co. at $16,279, the other bidders being Jones, Pollard & Co., $16,800; Campbell & Zell Co., $16,987; Pennsylvania Steel Co., $17,735; Penn Bridge Co., $17,984; Andrew Brown, $19,941. The new bridge will be of steel, and will take the place of the existing bridge, which is said to be in bad condition.

BINGHAMTON, N. Y.—A viaduct is to be built over the railway track at Chenango St.

GLENDENIN, W. VA.—J. W. Topping, St. Albans, has been awarded the contract for the substructure of the bridge to be built across the Elk River at this place, at $7,006, and the Canton Bridge Co. that for the superstructure, at $7,800.

BRONSON, FLA.—Bids are asked by the commissioners of Levy county until Oct. 1 for building three bridges.

TOLEDO, O.—The proposition to issue $200,000 in bonds for a bridge across the Maumee River will be voted upon this fall.

WARREN, O.—The city clerk has been directed to advertise for bids for the construction of a bridge across the river at Smith St.

ALBION, MICH.—F. Laberteaux, Cy. Clk., writes us that the following bids were received for constructing the bridge recently advertised in Engineering News:

Wheaton Bride Co.	steel, $670; wood, $530
Jackson Bridge & Iron Co. (two plans)	$371 and $415
Massillon Bridge Co.	545 and 630
Wrought Iron Bridge Co.	550 and 700

DETROIT, MICH.—The contract for the construction of the iron work for the Twelfth and Howard St. bridge has been awarded to Keepers & Wynkoop. The Michigan Central will build the abutments. The bids were as follows:

Keepers & Wynkoop (Detroit Br. & I. Wks.	$22,975
King Bridge Co., Cleveland, O.	24,195
Milwaukee Bridge & Iron Wks.	25,875
R. D. Wheaton Bridge Co., Chicago,	23,900
Wrought Iron Bridge Co., Canton, O.	24,900
Toledo Bridge Co., Toledo, O.	24,300
Wisconsin Bridge & Iron Co.	26,700
Jackson Bridge & Iron Co.	23,100
Variety Iron Works Co., Cleveland, O.	25,400
Massillon Bridge Co., Massillon, O.	24,000

THREE RIVERS, MICH.—A highway bridge near this place collapsed Sept. 22.

FALLS CITY, NEB.—The middle span of a highway bridge 1½ miles south of this village collapsed under a threshing machine Sept. 20.

NEW WHATCOM, WASH.—Bids are asked by the county commissioners for the construction of bridges over the Nooksack at Acme and Welcome, to cost about $1,500 each.

SEATTLE, WASH.—Bids are asked until Oct. 1 for the construction of one bridge pier, one combination span about 182 ft. long, and about 125 ft. of pile trestle approach, said bridge to be located at Patton's Place, on Green River. F. A. Twichell, Audr. King County.

SPRAGUE, WASH.—Lincoln county commissioners will be petitioned for a bridge to be built in connection with Stevens county over the Spokane River, several miles above Fort Spokane, for the benefit of a large body of settlers in the Price valley country.

WATER-WORKS.

CANAAN, VT.—The Stoddard Aqueduct Co. has been incorporated by C. T. Stoddard, Canaan; W. D. Moulton, C. B. Dunton and others, Portland, Me.; capital stock, $10,000; proposed works include a reservoir.

HATFIELD, MASS.—Surveys for the new works are nearly completed.

NORTON, MASS.—A committee has recommended that works be put in.

ALBANY, N. Y.—Bids are asked until Oct. 2 for 260 gross tons of 12 to 6-in. cast iron pipe. Geo. I. Bailey, Supt.

ELLICOTTVILLE, N. Y.—The works are to be extended and improved.

FORT PLAIN, N. Y.—Wm. Clark and others have been appointed commissioners to secure plans for new works.

JOHNSTOWN, N. Y.—An election will be held Oct. 2 to vote on an appropriation of $75,000 for extensions and improvements.

MILAN, N. Y.—It is reported that U. J. Rogers has completed plans for works which will be put in at once.

PELHAM MANOR, N. Y.—The village has contracted with the New York City District Water Supply Co. for works.

RICHMOND HILL, N. Y.—The Jamaica Water Supply Co. has been granted permission to lay 7,675 ft. of mains in this village.

ROCHESTER, N. Y.—A contract for stop-valves has been awarded to the Rensselaer Mfg. Co., at $1,163. The Eddy Valve Co. and the Ludlow Mfg. Co. also submitted bids.

AVALON, PA.—The Riverview Water Co. has been incorporated to put in works; capital stock, $1,000; Treas., John Johnson, Bellevue, Pa.

LIVERPOOL, PA.—The Liverpool Water Co. has been incorporated to supply the borough with water; capital stock, $5,000; Treas., E. H. Leffler, Millersburg, Pa.

MOUNT JEWETT, PA.—A water company has been organized with a capital stock of $8,000.

SEAFORD, DEL.—It is stated that an election will soon be held to vote on the question.

MOUNTAIN LAKE PARK, MD.—Works will be put in, according to reports. Address L. T. Yoder, Yoder Law Bldg., Pittsburg, Pa.

PETERSBURG, VA.—Bids are asked until Oct. 1 for the construction and erection complete of one 66-in. horizontal tubular boiler. John W. Hays, Cy. Engr.

BENWOOD, W. VA.—It is stated that the Benwood Water-Works Co. is arranging to put in works. J. M. Todd and G. O. Smith are interested.

GAFFNEY, S. C.—There is talk of constructing works.

COLUMBUS, GA.—We are informed that an ordinance has been introduced in the council providing for an election Dec. 8 to vote on an issue of $350,000 in bonds for new works.

CUTHBERT, GA.—Bids are asked until Oct. 15 for the purchase of $40,000 in water and $10,000 in electric light bonds; contracts for works will not be awarded until bonds are sold. Robt. L. Moye, Mayor.

DECATUR, ALA.—The only bid for the works, which were sold Sept. 17 to satisfy a mortgage amounting to $300,000, was that of Judge Prittle, Louisville, Ky., who purchased the complete plant for the bondholders at $40,000.

WARRIOR, ALA.—The Pearson Coal & Iron Co is reported as contemplating putting in works.

COFFEEVILLE, MISS.—There is talk of constructing works; supply from springs.

WATER VALLEY, MISS.—It is stated that works will be constructed. G. D. Able is Mayor.

ALEXANDRIA, LA.—The contract for works and an electric light plant has been awarded to the Southern Electrical & Supply Co., New Orleans, at $44,000.

CADIZ, O.—The question of works is to be voted upon again, according to reports.

ATTICA, O.—Bids are asked until Oct. 22 for the purchase of $15,000 in water-works bonds. W. H. H. Miller, Village Clk.

BRIGHTWOOD, IND.—William Sanders writes us that only 11 votes were cast against issuing bonds for constructing works, at the election Sept. 22; no engineer has been engaged to prepare plans, which will include 4 or 5 miles of 8 to 4-in. mains; supply from deep well; population, 3,000.

LAKEVIEW, MICH.—It is stated that the question of works will soon be voted upon.

NILES, MICH.—Bids are asked until Oct. 2 for constructing works (postponement of date from Sept. 25), as stated in our advertising columns. B. F. Earl, Chn. Com.

UNION CITY, MICH.—The citizens have voted to issue $20,000 in bonds for works.

BELLEVILLE, ILL.—The council is reported to have practically killed the ordinance granting a franchise to the Quickley Water-Works Co.

COLFAX, ILL.—A site has been purchased and it is reported that a well will be sunk and works constructed.

DE KALB, ILL.—E. A. Porter, Cy. Clk., writes us that the contract for additional pump and motor is about to be awarded to the Gould Mfg. Co., Seneca Falls, N. Y., at $7,000, and that contracts have been awarded to Peterson & Kyland for a 500,000-gallon reservoir at $6,000, and to the De Kalb Electric Co. for furnishing power at 4 cts. per 1,000 gallons of water. The other bidders were the Deane Steam Pump Co., Henry R. Worthington, Merion & Hubbell, Sargent & Lundy, General Electric Co., Abendroth & Root Mfg. Co., Stirling Co., and Warren, Webster & Co.

LENA, ILL.—Chas. Waite is a member of a committee to secure estimates and information for works.

OHIO, ILL.—It is reported that works will be put in.

TOLONA, ILL.—The village board has voted to issue $5,000 in bonds for works.

GLENCOE, WIS.—An election will be held Oct. 1 to vote on the question of works estimated to cost $25,000.

TOMAH, WIS.—Bids are asked until Oct. 1 for the construction of works. H. J. Skinner, Cy. Clk.

WASHBURN, WIS.—The citizens have voted to purchase the works.

WAUPUN, WIS.—The citizens have voted to issue $40,000 in bonds for works.

CLARKSVILLE, IA.—Bids are asked by the city clerk for constructing works, according to reports.

HULL, IA.—The city has a $4,000 well and mains laid, according to reports, and will soon erect a tower or stand-pipe. Address James Vickers.

LISBON, IA.—P. Canfield Barney, Chillicothe, Mo., has been engaged to make plans for works.

MONTEZUMA, IA.—The citizens have voted to construct works.

SPIRIT LAKE, IA.—An election was held Sept. 17 to vote on an issue of bonds for works.

COTTONWOOD, MINN.—The council is reported as considering a proposition for works.

FULDA, MINN.—Bids are asked until Oct. 6 for the purchase of $9,000 in bonds voted for works. Robt. Hyslop, Village Recdr.

LYLE, MINN.—Bids are asked until Oct. 1 for the construction of works and until Oct. 12 for the purchase of $5,000 in 6% bonds. J. A. Curran, Village Recdr.

MANHATTAN, KAN.—We are informed that the city is putting in a new suction pipe and rearranging the supply system of Cook wells, which are driven in gravel and sand bar in the Blue River.

HUMBOLDT, NEB.—Bids are asked until Oct. 12 for constructing works and for the purchase of $12,500 in bonds. Engr., A. A. Richardson, Lincoln. Address the city clerk.

LYONS, NEB.—Bids are asked until Oct. 10 for a stand-pipe, according to reports. H. McElhumey, Village Clk.

NEWCASTLE, NEB.—Chas. W. Woodward, Cy. Clk., writes us that works will probably not be put in this year, but that the question is being agitated.

TALMAGE, NEB.—An election will be held Oct. 12 to vote on a proposition for works. Engr., A. A. Richardson, Lincoln.

VALLEY CITY, N. DAK.—The citizens have voted in favor of works.

OREGON, MO.—Bonds will probably be voted for works. J. E. Cummins, Mayor.

SALISBURY, MO.—The citizens have voted to issue bonds for works.

FAYETTEVILLE, ARK.—Geo. C. Morgan, Chicago, has been engaged to make plans for works.

CAMERON, TEX.—Bids will soon be asked for constructing works and an electric light plant, according to reports. About $23,000 worth of stock has already been subscribed for by local parties.

PARK CITY, UTAH.—We are informed that the construction of works has been commenced. J. W. D. Moody has the construction in charge.

SALT LAKE CITY, UTAH.—The council is considering the construction of a tunnel 2,000 ft. in length in Emigrant Canyon, to be constructed this next winter, for water development purposes.

PORTLAND, ORE.—Bids are asked until Oct. 8 for the purchase of $400,000 in 30-year 5% water bonds. F. T. Dodge, Clk. Com.

LOS ANGELES, CAL.—At a mass meeting last week the citizens voted in favor of the council calling an election to vote $200,000 in bonds for works in Elysian Park.

STOCKTON, CAL. — The Farmers' Co-operative Water Co. has been incorporated with a capital stock of $1,000,000 by H. W. Correll, R. E. Wilhoit, N. S. Harold, G. W. Wigley, E. N. Pierce and others.

HULL, QUE.—It is stated that a contract for works has been awarded to Mr. Bourque at $50,000 to $40,000. F. A. Hibbert is the corporation engineer.

ARTESIAN WELLS.

GIBSON'S STATION, N. C.—Bids are asked for boring an artesian well, according to reports. J. H. McIlwinen.

WENONA, ILL.—Bids are asked until Oct. 1 for boring an artesian well. C. E. Erwin, Cy. Clk.

IRRIGATION.

GREAT BEND, KAN.—Bids are asked by the Barton County Irrigation Co., according to press reports, for the construction of a canal to irrigate 200,000 acres of the Arkansas and Walnut Valleys and the Cheyenne Bottoms, on the north side of the river near this city. A. J. Hoisington has charge of the enterprise.

NEW COMPANIES.—Cedar Creek Pumping Irrigation Co., Sterling, Colo.; $100,000; Eugene Buchanan, Dixon Buchanan, W. E. Crissman, all of Sterling, Colo.——Sacramento Delta Canal Co., San Francisco, Cal.; $500,000; Henry E. Simmons, Summit, N. J.; Chas. H. Leadbetter, Aylett R. Colton, Albert L. Bancroft, Annie M. Leadbetter, San Francisco.

SEWERS.

CLAREMONT, N. H.—The citizens have voted to organize a district to construct a system. H. A. Haskell, Clk.

LUDLOW, VT.—The contract for constructing a system has been awarded to E. Gustine & Son, Keene, N. H. Engr., G. N. Merrill, Springfield, Mass.

BROOKLYN, N. Y.—Bids are asked until Oct. 4 for constructing a sewer in Central Ave. A. T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—The council has passed ordinances for constructing 30 to 21-in. brick and 15 to 10-in. pipe sewers in several streets.

FAR ROCKAWAY, N. Y.—W. A. Wynn, L. T. Mulhearn and Archibald Mutch have been appointed commissioners to consider plans for a system.

LITTLE FALLS, N. Y.—The board of trustees have received the following bids for constructing a trunk sewer in South Ann St.: H. S. Eveline, $4,368; M. Sullivan, $4,950; McDermott & Lansing, $5,243; Hallinan Bros. & Fenton, $5,321.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2,622 Third Ave., until Oct. 2 for constructing sewers in three streets.

MEADVILLE, PA.—The following bids have been received for constructing sewers:

	Poplar St.	Pine St.	Park Ave.
Jones & Sullivan, Erie.....	$1,333	$1,311	$1,740
Murphy & Kavanaugh, Erie..	1,792	1,647	.....
Lyle & Morton, Erie.....	1,996	1,997	2,610
Thos. McGuigan, Meadville...	2,031	1,962	2,602
Menelee & Cunningham, Ellwood City	2,201	2,362	3,022
G. J. Vetter, Youngstown, O..	2,277	2,391	3,035

SCRANTON, PA.—Bids are asked until Oct. 4 for constructing a main sewer. M. T. Lavelle, Cy. Clk.

SUSQUEHANNA, PA.—The construction of a system is being discussed.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Oct. 13 for furnishing sewer pipe and invert blocks, as stated in our proposal columns.——The commissioners have ordered the construction of sewers in 14 streets, estimated to cost about $7,500.

HUNTSVILLE, ALA.—Bids are asked until Oct. 1 for the purchase of $10,000 in 30-year 5% sewer bonds. W. R. Van Valkenberg, Chn. Com.

SOUTH BEND, IND.—Bids are asked until Oct. 8 for constructing pipe sewers in two streets. L. A. Hull, Cy. Clk.

SAGINAW, MICH.—The council has received the following bids for constructing an outlet sewer from State St. to Saginaw River:

E. Jochen	$9,043
J. C. & A. Davies	9,955
D. J. Kennedy	10,375
Koch & McLellan	10,936
Eddy & Co.....	11,082
Lamson & Crowley	11,473
Z. Lalonde	12,020
A. L. Sager.....	12,590
Armstrong & Wilson	13,516
John C. Davies	16,102

CHICAGO, ILL.—Bids are asked until Oct. 2 for constructing private drains in seven streets. H. J. Jones, Comr. Pub. Wks.

PEKIN, ILL.—Plans for a system are being prepared by Harman & Evans, Consult. Engrs., Peoria, in connection with J. C. Aydelott, Cy. Engr.

WATERTOWN, WIS.—The council has voted to issue $18,000 additional 5% sewer bonds.

DES MOINES, IA.—The construction of 36 to 12-in. sewers in nine streets is being discussed by the council.

WESTPORT, MO.—The citizens have voted to construct a system.

SAN ANTONIO, TEX.—Bids are asked until Oct. 15 for the purchase of $500,000 in 40-year 5% sewer bonds. Henry Elmendorf, Acting Mayor.

SACRAMENTO, CAL.—The committee has recommended the adoption of the plans made by F. T. Newberry for a system; estimated cost, $172,946.

LINDSEY, ONT.—An election was held Sept. 20 to vote on the question of spending $25,000 in bonds for a system.

STREETS.

HARTFORD, CONN.—The Hartford Paving & Construction Co. has been organized with a capital stock of $10,000; Treas., Charles Crawford, C. E., 103 Wethersfield Ave.

BROOKLYN, N. Y.—Bids are asked until Oct. 3 for paving portions of 40th St. with cobble stones and Belgian blocks. A. T. White, Comr. Cy. Works.

BUFFALO, N. Y.—Bids are asked until Oct. 9 for paving eight streets with asphalt, stone or brick. R. G. Parsons, Secy. Dept. Pub. Wks.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2622 Third Ave., until Oct. 2 for laying crosswalks in two streets and for paving a portion of the roadway of 159th St. with trap rock.

POUGHKEEPSIE, N. Y.—The contract for paving Main St. with asphalt blocks has been awarded to the Hastings Pavement Co., New York.

PITTSBURG, PA.—The city engineer, the director of public works and the superintendent of the bureau of highways, are investigating the construction of a proposed boulevard to Beechwood, a distance of 12 miles.

LAUREL, MD.—Bids are asked until Oct. 1 for grading, curbing, etc., on Main St. G. W. Bond, Clk.

DE LAND, FLA.—The bids for paving the boulevard with brick have been rejected as too high, and the work will be readvertised. Engr., S. B. Wilson.

CLEVELAND, O.—The council has received the following bids for paving Dennison St. with brick:

Peter Rothenbecker, Cleveland vitrified.....$15,205	
M. F. Bramley, Cleveland vitrified.....	15,341
Thomas Connovan, iron rock shale paver.....	14,782
M. I. DeCelle, Salem Garfield.....	15,134
Christ Lards, blue granite block of Canton....	14,770
Charles Roehl, Cleveland vitrified.....	15,037
Buettner & Orley, iron rock paver of Canton...	16,573
Burgess & Gribben, blue granite lag blocks of Canton	18,983

COLLINWOOD, O.—Bids are asked until Oct. 8 for flagging and crosswalks. L. A. Wilson, Village Clk.

HAMILTON, O.—Bids are asked until Oct. 2 for paving Central Ave. with cement. J. J. McMaken, Cy. Clk.

WARREN, O.—The city clerk has been directed to advertise for bids for repaving Market St. and Park Ave.

MUNCIE, IND.—Bids are asked until Oct. 8 for improving the sidewalks in three streets. F. A. Elrod, Cy. Clk.

SOUTH BEND, IND.—Bids are asked until Oct. 8 for paving certain streets. L. A. Hull, Cy. Clk.

OHICAGO, ILL.—The Chicago Paving Supply Co. has been incorporated with a capital stock of $200,000; incorporators, H. J. Kendig, W. R. Wagner and J. H. Lewis.

MINNEAPOLIS, MINN.—The Columbia Paving Co. has been incorporated with a capital stock of $25,000; incorporators, Erick Westland, C. L. Johnson, O. J. Olson.

ELECTRIC LIGHT AND POWER.

SIDNEY, N. Y.—A company has been formed in Cooperstown which is reported as to contract with this place for lighting the town with electricity. The plant will cost about $20,000. It is probable that Bainbridge will also be supplied.

ETNA, PA.—It is reported that work will soon begin on an electric light plant estimated to cost $15,000.

PHILADELPHIA, PA.—Bids are asked until Oct. 3 for an electric lighting plant at the League Island navy yard. Address E. O. Matthews, Ch. of Bureau of Yards and Docks, Washington, D. C.

TOWSON, MD.—The Mount Washington Electric Light & Power Co. has extended its wires to this place with a view to lighting the streets and houses. M. W. Offutt is interested.

RICHMOND, VA.—The superintendent of the city gas works has been directed to secure estimates for a municipal electric light plant.

PALATKA, FLA.—A franchise has been granted to the electric company, recently incorporated, to construct a plant. E. E. Haskell is interested.

MARTIN'S FERRY, O.—The citizens have voted to issue $30,000 in bonds for an electric light plant.

CROSWELL, MICH.—It is reported that the construction of an elecric light plant is being discussed.

CHICAGO, ILL.—Bids are asked until Oct. 2 for constructing foundations for engine and shafting in the electric light station at 200 South Halsted St. H. J. Jones, Comr. Pub. Wks.

TOLONO, ILL.—It is reported that steps are being taken to secure an electric light plant.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Co. is reported as intending to build a new 100 × 151-ft. brick and stone power house and a 60 × 151-ft. boiler house. Three 800-HP. turbine water wheels and a 3,500-HP. steam engine will be put in. The work is estimated to cost $200,000.

HAMILTON, ONT.—W. H. Glassco, W. Southam, Richard Fuller, J. W. Osborne and John Patterson, of this city, have applied for the incorporation of the Cataract Power Co., with a capital stock of $100,000. The object of the company is to bring electrical power from Niagara Falls to Hamilton.

AYLMER, QUE.—R. & W. Conroy have been granted a franchise for an electric light plant.

NEW COMPANIES.—Hillsboro Light & Fuel Co., Hillsboro, O.; $20,000; J. R. Cook, E. W. Bixby, H. H. Campbell.——Interstate Fuel, Light & Power Co., Chicago, Ill.; $6,000,000; J. W. Keneval, J. I. McCauley, Charles Rose.——Scranton Electric Construction Co., Scranton, Pa.; $15,000; Treas., F. E. Platt.——New London Electric Light Co., New London, O.; $4,000; D. J. C. Arnold, H. G. Skinner, C. E. Reynolds, S. J. McCready.——Los Angeles Gas & Electric Fixture Mfg. Co., Los Angeles, Cal.; $50,000; Max Meyberg, Simon Nordlinger.——Cumberland Light, Heat & Power Co., Mechanicsburg, Pa.; $50,000; Supt., F. K. Alleman, Steelton.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

CULVERT.—Des Moines, Ia.—Bids are asked by the board of public works until Oct. 9 for the construction of a 36-in. double-ring brick culvert.

JAIL.—Atlanta, Ga.—An election will be held Oct. 3 to vote on an issue of $150,000 of 4½% bonds for a new county jail. John T. Cooper, Clk. Comrs.

TELEPHONE FRANCHISE.—Massillon, O.—The Farmers' Telephone Co. is reported to have been granted an unlimited franchise by the council.

LEVEE WORK.—Memphis, Tenn.—Bids are asked until Oct. 5 for construction and repairs of levees in the Upper Yozoo levee district. Lieut. J. C. Sanford, U. S. Engr. Office.

LEDGE WORK—Boston, Mass.—Bids are asked until Oct. 8 for removal of ledge from Nantasket Beach Channel, Boston Harbor. Lieut.-Col. S. M. Mansfield, U. S. Engr. Office.

REVETMENT.—Duluth, Minn.—Bids are asked until Oct. 4 for repair of timber revetment at Lily Pond, in the Portage Lake ship canals, Mich. Maj. Clinton B. Sears, U. S. Engr. Office.

REMOVAL OF LEDGES—Boston, Mass.—Bids are asked until Oct. 22 for the removal of ledges from Boston Harbor, as stated in our advertising columns. Lieut.-Col. S. M. Mansfield, U. S. Engr. Office.

JAIL CELLS, ETC.—Auburn, Cal.—Bids are asked until Oct. 19 for the construction of 12 jail cells, lining vaults and for a heating and ventilating system in the new Placer county courthouse. Geo. B. Hewes, Chn.

WHARF.—Boston, Mass.—It is stated that the Boston & Maine R. R. Co. will build a wharf 2,000 ft. in length on the Mystic River, Somerville, where some 100 acres of marsh land has been purchased and is being filled in.

CAPITOL BUILDING.—Olympia, Wash.—Bids are asked until Oct. 15 for the masonry of the foundation and basement, including excavation, etc., of the new capitol building. Address the secretary of the capitol commission.

PIERS—Norfolk, Va.—The Atlantic & Danville R. R. Co. has awarded the contract for three piers, 386 × 28 ft., 388 × 47 ft. and 400 × 45 ft., at West Norfolk, to the Delaware Construction Co., Washington, D. C., at $48,500.

GRANITE—St. Augustine, Fla.—Bids are asked until Oct. 25 for delivering 10,000 tons of granite or other durable rock upon the jetty at Key West Harbor, as stated in our advertising columns. Maj. Thos. H. Handbury, U. S. Engr. Office.

APPROACHES, ETC.—Detroit, Mich.—Bids are asked until Oct. 23 for the approaches, etc., for the U. S. public building in this city, as stated in our advertising columns. Address Chas. V. Kemper, Acting Supervising Arch., Treasury Dept., Washington, D. C.

DREDGING AND BREAKWATERS—New York, N. Y.—Bids are asked until Oct. 16 for dredging in Mystic River, Norwalk Harbor, Conn., and for constructing breakwaters at Duck Island Harbor, Conn., and Glen Cove Harbor, N. Y., as stated in our advertising columns. Lieut.-Col. Henry M. Robert, U. S. Engr. Office.

HEATING AND VENTILATING APPARATUS.—New Haven, Conn.—Bids are asked until Oct. 24 for removing the old steam-heating apparatus and putting in new heating and ventilating apparatus in the U. S. public building in this city, as stated in our advertising columns. Address Chas. E. Kemper, Acting Supervising Arch., Treasury Dept., Washington, D. C.

STEEL RAILS.—Ottawa, Ont.—Bids are asked until Oct. 16 for the supply of 1,000 tons of 50-lb. steel rails to be delivered on Prince Edward Island Ry. wharf; 300 tons of 56-lb. steel rails to be delivered on the Intercolonial Ry. wharf at Richmond, N. S.; 3,000 tons of 67-lb. steel rails to be delivered on the Intercolonial Ry. wharf at Levis, opposite Quebec. J. H. Balderson, Secy. Dept. Rys. and Canals.

NAVAL SUPPLIES—Washington, D. C.—Bids are asked until Oct. 2 for two slotting machines, four horizontal boring and drilling machines, one 40-HP. engine, two electric traveling cranes, planing machines, etc., for the Washington navy yard; steel plates, angles, rivets, pipe, etc., for the New York navy yard; and 150,000 lbs. iron for chain cable for the Boston navy yard. Edwin Stewart, Paymaster Gen., U. S. N.

DITCHES, FLUMES, ETC.—Junction City, Cal.—F. Huertevant, Gen. Man., writes us that King & Ballard, Denver, Colo., have been awarded a contract at $12,200, the work requiring the construction of about 3,518 ft. of flumes, 6 ft. wide and 4 ft. deep; three large tanks at ends of pipe lines; 990 ft. of ditch, 7½ ft. wide on top, 4½ ft. wide on bottom and 4 ft. deep; 28,200 ft. of ditch to be deepened 1 ft., and about 12,000 ft. of ditch to be widened from about 6 ft. on top and 4 ft. on bottom to 7½ ft. on top and 4½ ft. on bottom; also the construction of necessary waste gates, etc.; all lumber to be furnished.

PARK WORK, ETC.—New York, N. Y.—Bids are asked by the department of parks until Oct. 3 for tiling the floor of the aquarium in the Castle Garden building, in Battery Park; construction of area wall and drainage around the westerly side of the American Museum of Natural History building on Manhattan Square; construction of driveway, bridge, etc., and improving grounds adjoining, in Central Park, for entrance at 110th St. W.; construction of foundation walls, furnishing and setting granite coping, posts, platforms, steps, sills, braceposts and bluestone gateposts at eight entrances to Mount Morris Park; and for the erection of iron railings and gates at eight entrances to Mount Morris Park.

DREDGING—New York, N. Y.—Bids are asked until Oct. 11 for dredging the channel in Newtown Creek, N. Y.; until Oct. 15 for dredging the channels in Raritan Bay, N. Y.; and until Oct. 18 for 360,000 cu. yds. of dredging from Harlem River and Spuyten Duyvil Creek and for 500 lin. ft. of pile revetment. 2d Lieut. Robt. McGregor, U. S. Engr. Office.

Milwaukee, Wis.—Bids are asked until Oct. 3 for 30,000 cu. yds. of dredging in Milwaukee Harbor, as stated in our advertising columns. Maj. James F. Gregory, U. S. Engr. Office.

Portland, Me.—Bids are asked until Oct. 15 for dredging in Back Cove, Portland Harbor, as stated in our advertising columns. Lieut.-Col. Peter C. Hains, U. S. Engr. Office.

GARBAGE CREMATORIES.—St. Paul, Minn.—Bids are asked until Sept. 28 for the construction of a garbage crematory, to cremate 100 tons of garbage every 24 hours. Thos. A. Prendergast, Cy. Clk.

Fort Wadsworth, New York Harbor.—Lieut. R. H. Patterson, A. A. Q. M., writes us that the following bids were received for the erection of the proposed garbage crematory:

C. McLean, 415 Broadway, New York.....$1,475	
Manhattan Supply Co., 141 Chambers St., N. Y..	4,347
Whittier & Knapp, 70 Rush St., Brooklyn.....	2,757
Allston Gerry, 541 E. 118th St., New York....	2,500
Frank Rinschler, Stapleton, S. I., N. Y.....	1,774
K. A. Murphy, 90 Lenwood St., Brooklyn....	2,200
Ph. Wolff & Sons, Stapleton, S. I., N. Y....	1,894
Engle Sanitary & Cremat'n Co., 30 State St., N. Y.	1,850
Engle Sanitary & Cremation Co. (own plans)....	1,725

LIGHT STATION.—New Orleans, La.—Maj. Jas. B. Quinn, U. S. Lighthouse Engr., writes us that the following bids were received Sept. 11 for the erection of Crooked River light station, Fla.:

Bids for Furnishing the Metal Work.

John P. McGuire, Cleveland O.	$12,435
Vulcan Iron Works, Chicago, Ill.	10,842
Gillette-Herzog Mfg. Co., Minneapolis, Minn.	8,950
Tacony Iron & Metal Co., Philadelphia, Pa.	7,392
Phoenix Iron Co., Philadelphia, Pa.	43,560
Snead & Co. Iron Works, Louisville, Ky.	9,986
Allentown Rolling Mills, Allentown, Pa.	9,383
Wehner Machine Works Co., Lebanon, Pa.	10,438
Russel Wheel & Foundry Co., Detroit, Mich.	9,444

Bids for Erecting the Tower and Keeper's Dwellings.

Holtzclaw Bros., Washington, D. C.	$12,486
S. S. Leonard & Co., Mobile, Ala.	14,000
Gude & Walker, Atlanta, Ga.	11,777
L. C. Le Corgne, New Orleans, La.	15,462
J. B. Camors & Co., New Orleans, La.	14,400
Andrew Downey, New Orleans, La.	16,600

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Sept. 28.	Garbage crematory,	St. Paul, Minn.	Sept. 27
Sept. 28.	Stone arch bridge,	Sandusky, O.	Aug. 30
Sept. 28.	Paving (10,174 sq.yds.), Advertised, Eng. News, Aug. 30 to Sept. 20.	Van Wert, O.	Aug.30
Sept. 28.	Water-wks. system, Advertised, Eng. News, Sept. 6 and 13.	Morrisville, N. Y.	Sept. 13
Sept. 28.	Pipe sewers,	Elizabeth, N. J.	Sept. 13
Sept. 28.	Canal repairs,	Albany, N. Y.	Sept. 20
Sept. 28.	Disinfecting plant,	San Diego, Cal.	Sept. 20
Sept. 29.	Bridges,	Indianapolis, Ind.	Aug. 23
Sept. 29.	Water-wks. system,	Cattaraugus, N. Y.	Sept. 13
Sept. 29.	Jetties, Advertised, Eng. News, Sept. 13 to 27.	Savannah, Ga.	Sept. 13
Sept. 29.	Bridge substructure,	Cleveland, O.	Sept. 20
Oct. 1.	Electric lighting,	Vicksburg, Miss.	Aug. 30
Oct. 1.	Water power canal, Advertised, Eng. News, Sept. 13 to 20.	Model City, N. Y.	Sept. 13
Oct. 1.	Macadamizing,	Columbus, O.	Sept. 13
Oct. 1.	Paving,	Toledo, O.	Sept. 13
Oct. 1.	Water-wks. system,	Rossville, Ill.	Sept. 20
Oct. 1.	Stand-pipe, Advertised, Eng. News, Sept. 20.	Medford, Mass.	Sept. 20
Oct. 1.	Grading,	Laurel, Md.	Sept. 27
Oct. 1.	Horiz. tubular boiler,	Petersburg, Va.	Sept. 27
Oct. 1.	Sewer bonds ($10,000),	Huntsville, Ala.	Sept. 27
Oct. 1.	Bridges,	Bronson, Tex.	Sept. 27
Oct. 1.	Bridge work,	Seattle, Wash.	Sept. 27
Oct. 1.	Artesian well,	Wenona, Ill.	Sept. 27
Oct. 1.	Water-works system,	Tomah, Wis.	Sept. 27
Oct. 1.	Water-works system,	Lyle, Minn.	Sept. 27
Oct. 2.	Electric lighting,	Jackson, Tenn.	Aug. 30
Oct. 2.	Water-wks. system, Advertised, Eng. News, Aug. 23 to Sept. 13.	Greenville, Mass.	Aug. 23
Oct. 2.	Pipe, etc. (20 miles), Advertised, Eng. News, Sept. 13 to 27.	Beaver Falls, Pa.	Sept. 13
Oct. 2.	Sewer,	Brooklyn, N. Y.	Sept. 20
Oct. 2.	Reformatory bldg.,	Napanoch, N. Y.	Sept. 20
Oct. 2.	Asphalt paving,	Brooklyn, N. Y.	Sept. 20
Oct. 2.	Stone paving,	Oak Harbor, O.	Sept. 20
Oct. 2.	Pipe sewers, Advertised, Eng. News, Sept. 20 and 27.	Connersville, Ind.	Sept 20
Oct. 2.	Water-works system, Advertised, Eng. News, Sept. 20 and 27.	Niles, Mich.	Sept. 27
Oct. 2.	Iron for chain cable,	Boston Navy Y'd.	Sept. 27
Oct. 2.	Cast iron pipe,	Albany, N. Y.	Sept. 27
Oct. 2.	Steel plates, etc.,	New York Navy Y'd.	Sept. 27
Oct. 2.	Trap rock paving,	New York	Sept. 27
Oct. 2.	Sewers,	New York, N. Y.	Sept. 27
Oct. 2.	Trav'l'g cranes, etc.,	Washington, D. C.	Sept. 27
Oct. 2.	Cement paving,	Hamilton, O.	Sept. 27
Oct. 2.	Drains,	Chicago, Ill.	Sept. 27
Oct. 2.	Engine foundations,	Chicago, Ill.	Sept. 27
Oct. 3.	Bridge, Advertised, Eng. News, Sept. 13.	New Brunswick, N. J.	Sept. 13
Oct. 3.	Dam, pump plt, etc., Advertised, Eng. News, Sept. 13 to 27.	Dallas, Tex.	Sept. 13
Oct. 3.	Sewer system, Advertised, Eng. News, Sept. 20 and 27.	Cazenovia, N. Y.	Sept. 20
Oct. 3.	Armory building,	Hornellsville, N. Y.	Sept. 20
Oct. 3.	Bridge superstructure,	Cleveland, O.	Sept. 20
Oct. 3.	Engine house,	Buffalo, N. Y.	Sept. 20
Oct. 3.	Stone paving,	Brooklyn, N. Y.	Sept. 27
Oct. 3.	Park work, etc.,	New York, N. Y.	Sept. 27
Oct. 3.	Electric light plant,	Phila. Navy Yard.	Sept. 27
Oct. 3.	Dredging, Advertised, Eng. News, Sept. 27.	Milwaukee, Wis.	Sept. 27
Oct. 4.	Rubble stone (2 contracts), Advertised, Eng. News, Sept. 6 to 20.	Boston,	Sept. 6
Oct. 4.	Dredging, Advertised, Eng. News, Sept. 6 to 20.	Boston, Mass.	Sept. 6
Oct. 4.	Dredging, Advertised, Eng. News, Sept. 6 to 27.	Washington, D. C.	Sept. 6
Oct. 4.	Stone, etc., Advertised, Eng. News, Sept. 6 to 20.	Washington, D. C.	Sept. 13
Oct. 4.	Dredging, Advertised, Eng. News, Sept. 6 to 20.	Washington, D. C.	Sept.13
Oct. 4.	Bridge,	Cleveland, O.	Sept. 13
Oct. 4.	Concrete or stone bridge,	Cincinnati, O.	Sept. 20
Oct. 4.	Spruce timber,	New York, N. Y.	Sept. 20
Oct. 4.	Belgian block paving,	New York	Sept. 20
Oct. 4.	Sewer,	Brooklyn, N. Y.	Sept. 27
Oct. 4.	Sewer,	Scranton, Pa.	Sept. 27
Oct. 4.	Timber revetment,	Duluth, Minn.	Sept. 27
Oct. 5.	Breakwater repairs, Advertised, Eng. News, Sept. 6 to 27.	Burlington, Vt.	Sept. 6
Oct. 5.	Dredging (2 contracts), Advertised, Eng. News, Sept. 6 to 27.	Burlington, Vt.	Sept. 6
Oct. 5.	Rock excavation, Advertised, Eng. News, Sept. 6 to 27.	Burlington, Vt.	Sept. 6
Oct. 5.	Electric fixtures, etc.,	Denver, Colo.	Sept. 13
Oct. 5.	Land reclamation, Advertised, Eng. News, Sept. 20 and 27.	Islip, N. Y.	Sept. 20
Oct. 5.	Levee work,	Memphis, Tenn.	Sept. 27
Oct. 6.	Arch culvert,	Cincinnati, O.	Sept. 20
Oct. 6.	Macadamizing,	Norwood, O.	Sept. 20
Oct. 6.	Water bonds,	Fulda, Minn.	Sept. 27
Oct. 8.	Rubble stone, Advertised, Eng. News, Sept. 13 to 27.	Boston, Mass.	Sept. 13
Oct. 8.	Dredging, Advertised, Eng. News, Sept. 13 to 27.	Boston, Mass.	Sept. 13
Oct. 8.	Ledge work,	Boston, Mass.	Sept. 27
Oct. 8.	Crosswalks, etc.,	Collinwood, O.	Sept. 27
Oct. 8.	Sidewalk improvements,	Muncie, Ind.	Sept. 27
Oct. 8.	Pipe sewers,	South Bend, Ind.	Sept. 27
Oct. 8.	Paving,	South Bend, Ind.	Sept. 27
Oct. 8.	Water bonds ($400,000),	Portland, Ore.	Sept. 27
Oct. 9.	Electric lighting, Advertised, Eng. News, Sept. 20 and 27.	Cynthiana, Ky.	Sept. 20
Oct. 9.	Buildings, etc.,	Washington, D. C.	Sept. 13
Oct. 9.	Paving (8 streets), Advertised, Eng. News, Sept. 13 to 20.	Buffalo, N. Y.	Sept. 27
Oct. 9.	Culvert,	Des Moines, Ia.	Sept. 27
Oct. 10.	Sewer pipe, Advertised, Eng. News, Sept. 20 to Oct. 4.	Jacksonville, Fla.	Sept. 20
Oct. 10.	Iron bridges,	Sherman, Tex.	Sept. 20
Oct. 10.	Stand-pipe,	Lyons, Neb.	Sept. 27
Oct. 11.	Pumping engines, Advertised, Eng. News, Sept. 13 to 27.	Chicago, Ill.	Sept. 20
Oct. 11.	Dredging (2 contracts), Advertised, Eng. News, Sept. 13 to Oct. 4.	Norfolk, Va.	Sept. 1
Oct. 11.	Dredging, Advertised, Eng. News, Sept. 20 to Oct. 11.	New York, N. Y.	Sept. 20
Oct. 11.	Dredging, Advertised, Eng. News, Sept. 20 to Oct. 4.	Baltimore, Md.	Sept. 20
Oct. 11.	Dredging,	New York, N. Y.	Sept. 27
Oct. 12.	Public building, Advertised, Eng. News, Sept. 20 and 27.	Allegheny, Pa.	Sept. 20
Oct. 12.	Removing rock, etc.,	Detroit, Mich.	Sept. 20
Oct. 12.	Highway (6,500 lin. ft.),	Helena, Mont.	Sept. 27
Oct. 12.	Water bonds,	Lyle, Minn.	Sept. 27
Oct. 12.	Water-works system,	Humboldt, Neb.	Sept. 27
Oct. 12.	Water bonds,	Humboldt, Neb.	Sept. 27
Oct. 13.	Sewer pipe, etc., Advertised, Eng. News, Sept. 27 and Oct. 4.	Washington, D. C.	Sept. 27
Oct. 15.	Hire of dredging plant, Advertised, Eng. News, Sept. 20 to Oct. 4.	Buffalo, N. Y.	Sept. 20
Oct. 15.	Dredging, Advertised, Eng. News, Sept. 27 to Oct. 11.	New York, N. Y.	Sept. 27
Oct. 15.	Water bonds ($40,000),	Cuthbert, Ga.	Sept. 27
Oct. 15.	Sewer bonds ($500,000),	San Antonio, Tex.	Sept. 27
Oct. 15.	Capitol bldg. foundation,	Olympia, Wash.	Sept. 27
Oct. 15.	Dredging, Advertised, Eng. News, Sept. 27 to Oct. 11.	Portland, Me.	Sept. 27
Oct. 16.	Pumps and reservoirs, Advertised, Eng. News, Sept. 13 to 27.	Beaver Falls, Pa.	Sept. 13
Oct. 16.	Dredging, Advertised, Eng. News, Sept. 27 to Oct. 11.	New York, N. Y.	Sept. 27
Oct. 16.	Breakwaters, Advertised, Eng. News, Sept. 27 to Oct. 11.	New York, N. Y.	Sept. 27
Oct. 16.	Steel rails,	Ottawa, Ont.	Sept. 27
Oct. 17.	Electric lighting,	Oswego, N. Y.	Sept. 20
Oct. 17.	Riprap stone, Advertised, Eng. News, Sept. 20 to Oct. 11.	Washington, D. C.	Sept. 20
Oct. 17.	Dredging, Advertised, Eng. News, Sept. 20 to Oct. 11.	Washington, D. C.	Sept. 20
Oct. 18.	Dredging (360,000 cu.yds.),	New York.	Sept. 27
Oct. 18.	Pile revetment (500 ft.),	New York, N. Y.	Sept. 27
Oct. 19.	Jail cells, etc.,	Auburn, Cal.	Sept. 27
Oct. 22.	Water supply,	Jersey City, N. J.	Sept. 20
Oct. 22.	Ledge work, Advertised, Eng. News, Sept. 27 to Oct. 11.	Boston, Mass.	Sept. 27
Oct. 22.	Water bonds ($15,000),	Attica, O.	Sept. 27
Oct. 23.	Approaches, etc., Advertised, Eng. News, Sept. 27 and Oct. 4.	Detroit, Mich.	Sept. 27
Oct. 24.	Heating apparatus, Advertised, Eng. News, Sept. 27 and Oct. 4.	New Haven, Conn.	Sept. 27
Oct. 25.	Granite, Advertised, Eng. News, Sept. 27 to Oct. 18.	St. Augustine, Fla.	Sept. 27
Oct. 31.	Drawbridges, Advertised, Eng. News, Sept. 6 and 20.	Chicago, Ill.	Sept. 6
Oct. 31.	Bridge masonry, Advertised, Eng. News, Sept. 6 and 20.	Chicago, Ill.	Sept. 6
Nov. 6.	Filter plant, Advertised, Eng. News, Sept. 13 to 27.	Beaver Falls, Pa.	Sept. 13
No date.	Canal work,	Los Angeles, Cal.	Sept. 13
	Advertised, Eng. News, Sept. 13 to Oct. 18.		
"	" Water mains, etc.,	Bancroft, Ia.	Sept. 20
"	" Electric light plant, Advertised, Eng. News, Sept. 20.	Lisbon, Ia.	Sept. 20
"	" Water-wks. system, Advertised, Eng. News, Sept. 20.	Lisbon, Ia.	Sept. 20
"	" Bridges,	New Whatcom, Wash.	Sept. 27
"	" Artesian well,	Gibson's Station, N. C.	Sept. 27
"	" Water-works system,	Clarksville, Ia.	Sept. 27
"	" Irrigation canal,	Great Bend, Kan.	Sept. 27

CONTRACT PRICES.

RESERVOIR.—Reading, Pa.—E. Chamberlain, Cy. Engr., writes us that the following bids were received Sept. 18 for constructing a high service reservoir and appurtenances, all the bidders being residents of Reading:

	P. F. Haw-man.	A. L. Ahrens & Frame.	Haw-Sny-der.	Bros.	Jacob Mayer.
Excavation, per cu. yd.	$0.20	$0.32	$0.32	$0.31	$0.37½
Concrete, per cu. ft.	8.00	5.00	4.90	6.25	5.95
Rubble masonry, cu. yd.	3.00	4.25	3.50	4.90	1.80
*Wyoming blue stone	.45	.60	.58	.65	.65
**Wyoming blue stone	.34	.65	.39	.75	.80
Wrought iron, per lb.	.027	.02	.03¼	.03	.01¾
Cast iron, per lb.	.03	.02	.03	.03	.02¾
Clearing, per acre	60.00	25.00	50.00	90.00	75.00
Grubbing, per acre	100	24.00	75.00	135	40.00
Gatehouse complete	518	775	740	1,068	799
Total	$9,756		$11,067		$12,826
Total	$11,048		$11,177		

* 4 × 20-in., per lin ft. ** 6-in., per sq. ft.

DRAINAGE CANAL—Chicago, Ill.—The lowest bid received Sept. 12 for completing the work on section E of the main drainage canal was that of Angus & Gindele, Chicago. The estimated amount of excavation is 1,294,000 cu. yds. of glacial drift, and 75,000 cu. yds. of rock. The bids per cu. yd. were as follows:

Bidder.	Glacial.	Rock.
J. D. Moran Const'n Co., St. Paul	$ .46	$ .80
Mallory, Cushing & Co., Omaha, Neb.	.31¾	.80
Lewis M. Loss, Chicago	.49	.49
Campbell, Dennis & Co., Joliet, Ill.	.31	.74½
Heidmeier & Neu, Chicago	.42	.92
F. C. Weir, Cincinnati	.33	.80
C. Sullivan	.36	.90
Panama Const'n Co., Chicago	.37½	.95
E. D. Smith & Co., Romeoville, Ill.	.37½	.70
Griffiths & McDermott	.394	1.00
Grace & Hyde Co., Chicago	.38	1.00
Lydon & Drews	.37	1.00
Angus & Gindele, Chicago	.27	.70

DREDGING—Pittsburg, Pa.—Capt. R. L. Hoxie, U. S. Engr. Office, writes us that the following bids were received Sept. 18 for about 63,000 cu. yds. of dredging in the Allegheny River, the price being per cubic yard measured in place, and all the bidders being residents of Pittsburg: Hulings Bros., 15.9 cts.; Iron City Sand Co., 15 cts.; Monongahela & Western Co., 14.9 cts.; J. K. Davison & Bro., 15.5 cts.; The Drake & Stratton Co., 14 cts.

SEWERS—Saginaw, Mich.—Udo Hesse, Asst. Cy. Engr., writes us that bids were opened Sept. 18 for the construction of a 6-ft. circular outlet sewer in Michigan and Genesee Aves., from State St. to Saginaw River. The location of the sewer is across a bayou, and the sewer will be constructed on the pile foundation of the street railway traversing said avenues; average cut, 5½ ft.; estimated length, 2,100 ft. The following are the prices bid by Ernest Jochen, the successful bidder:

6-ft. circular sewer, per ft.	$2.60
Extra brickwork, per M. brick	7.00
Stone masonry, per cu. yd.	1.75
Old piles, tested, driven and cut off, each	.50
New piles, furnished, driven and cut off, each	2.50
Timber in outlet and sewer foundation, per M. ft.	12.00
Catch basins, each	15.00
Manholes, each	10.00
*16-in. cast iron outlet pipe, per ft.	.25

*All material required in outlet pipe furnished by city; all other material, except cement, will be furnished by the contractor.

Chester, Pa.—James B. Campbell, Cy. Clk., writes us that the contract for constructing a sewer in Penn St. was awarded Sept. 17 to J. B. Helms, of this city, at $1.47 per lin. ft.; inlets, $60 each; manholes, $18.50 each; rock excavation, $2.25 per cu. yd.

Jersey City, N. J.—The following bids were received for constructing a main sewer in West Side, Yale, Malory and Hatch Aves. to Newark Bay, the bid of Burke & Jones being rejected as informal:

Bids Received at Jersey City, N. J., for Constructing a Main Sewer.

	Sewer, per lin. ft. Brick oval 30-in.	36-in.	40-in.	48-in.	Iron pipe, 48-in.	Piles, per lin.ft.	Yellow pine, floor-cap'g, M.ft.	Spruce ing, M.ft.	Rock excav. per cu.yd.	Re-ceiv-ing basins	Con-crete, per cu.yd.	Spruce sheath-ing, M.ft.	Brick per M.	Iron mas. bolts, per lb.	Iron sp'ks per lb.
Andrew Shaw	$3.71	$4.44	$4.60	$4.69	$11.10	$0.35	$21.00	$20.00	$0.01	$98.00	$4.00	$18.00	$9.00	$0.05	$0.02
Thomas Cogan	4.00	4.20	4.60	5.00	10.00	.16	32.00	26.00	.10	80.00	1.00	20.00	9.00	.03	.03
P. H. Flaherty, Jr.	2.99	3.49	4.00	4.90	11.80	.35	36.00	32.60	5.00	100.00	2.00	30.00	6.00	.12	.12
Henry Byrne	3.25	3.50	3.60	3.70	9.00	.25	30.00	25.00	2.00	60.00	10.00	25.00	10.00	.30	.30
John Hopkins	3.25	3.75	3.75	3.99	10.00	.20	28.00	?	.01	150.00	.01	25.00	8.00	.04	.04
William Robertson	3.75	4.00	4.50	5.50	10.00	.40	35.00	30.00	1.00	80.00	5.00	20.00	8.00	.05	.05
Edward O'Neill	3.25	3.50	3.60	3.75	9.50	.25	32.00	24.00	?	80.00	1.00	15.00	7.00	.05	.05
P. T. Plunkett	3.40	3.70	3.90	4.30	10.00	.12	35.00	40.00	.01	70.00	.01	.01	7.00	.10	.10
G. Van Keuren	3.40	3.65	3.79	4.00	9.10	.30	34.00	30.00	10.00	80.00	10.00	24.00	9.15	.05	.05
M. T. Connolly	2.75	3.00	3.25	3.49	9.50	.25	33.00	24.00	2.50	85.00	5.00	20.00	.01	.06	.03
James Billington	2.25	2.60	2.95	6.80	12.20	.20	32.50	17.50	.90	95.00	2.50	22.25	9.50	.02½	.03½
Thomas Hopkins	2.50	2.50	4.00	5.00	9.00	...	50.00	36.00	.01	100.00	.01	5.00	10.00	.01	.01
P. J. Mullery	3.60	4.60	5.60	6.60	12.00	.30	30.00	30.00	5.00	104.00	2.00	30.00	9.00	.01	.10

Wilmington, Del.—The total bids received for constructing the sewers recently advertised in Engineering News were published last week under Sewers. T. C. Halton, Engr., informs us that both contracts were awarded to John Jacoby, and that the bids for the Anchorage St. work were as follows; (1) being the bid of A. S. Reed Bro. & Co., Wilmington; (2) John Jacoby, Wilmington, Del.; (3) Joseph Jenkins, Wilmington; (4) Joseph McDonald & Co., 410 Girard Bldg., Philadelphia; (X) estimated cost of work if done by the city:

	1.	2.	3.	4.	X.
[1]66-in. brick, 335 ft.	$9.00	$8.50	$10.30	$9.94	$8.00
60-in. brick, 12 ft.	8.25	8.00	10.30	9.90	8.00
22 × 33-in. brick, 383 ft.	1.87	1.75	2.25	3.85	2.20
16 × 27-in. brick, 336 ft.	2.20	1.80	1.98	2.94	2.05
[2]18-in. pipe, 668 ft.	2.00	1.75	2.05	2.84	1.90
10-in. pipe, 536 ft.	.68	.60	.70	1.40	.65
18-in. Y's, 40	.80	1.50	1.50	2.44	2.07
10-in Y's, 30	.80	.60	.70	1.65	.57
Slants, 60	.50	.25	.30	.18	.15
Inlet plates, 8	50.00	40.00	48.00	63.00	27.00
" " 6	55.00	48.00	53.00	59.00	48.61
[3]Manholes, 2	42.00	45.00	60.00	39.00	48.00
[4] " 4	44.00	45.00	55.00	48.00	48.00
Lampholes, 2	5.00	5.00	7.00	28.00	7.50
Rock excav'n 150 cu. yds.	2.45	2.50	....	2.24	2.35
Vit. brick, laid, 3.4 M.	56.00	60.00	75.00	85.00	....

[1] Concrete cradle. [2] In concrete. [3] Manholes in pipe sewer. [4] Manholes in brick sewer.

PIPE AND PIPELAYING—Norwalk, O.—The contract for laying new water pipe in two streets has been awarded to Butt & Friend, at the following prices: 6-in. pipe, $18.50 per ton; 4-in. pipe, $18.00; lead and hemp, 4-in. joints, 25 cts. each, 6-in. joints, 35 cts. each; special castings, 2¼ cts. per lb.; Holly hydrants, $26.50 each; 4-in. gate valves, $7.50 each; 6-in. gate valves, $11.50 each; trenching, etc., 10 cts. per lin. ft.

PUMPING ENGINES—Providence, R. I.—The contract for three triple expansion sewage pumping engines of 36,000,000 gallons daily capacity each has been awarded to the Holly Mfg. Co., Lockport, N. Y., the contract including the necessary boilers to operate the engines. Local papers state that bids were received from seven different companies, and that the contract was awarded to the lowest bidders, at $100,000, including four Babcock & Wilcox boilers.

ELECTRIC AND GAS LIGHTING—Toronto, Ont.—Bids were opened Sept. 17 for the construction of a municipal electric light plant and also for lighting the

city. The city is now paying $108.59 per year per light for 1,300 arc lights of 2,000 c. p., and the city engineer estimated that the city could supply its own light at $82 per year per light. At the opening of bids Sept. 17 the Toronto Electric Co., which has the present contract, bid 20½ cts. per night, or $74.82½ per year, per light for a 5-year contract, and the Toronto St. Ry. Co. bid 23 to 21 cts. per night, or $83.95 to $76.66 per year, for light for a 5 to 25-year contract. The Consumers' Gas Co. submitted the following bid for gas lighting: For exclusive lighting of the city with gas on present mains, $22 per lamp per year; on new mains, $23 per lamp per year; for a minimum of 1,000 lights on the present mains, $25 per lamp per year; on new mains, $24 per lamp per year; Lambeth lamps, $70 per lamp per year. The present contract prices for gas are $24 and $25 per lamp per year, respectively, and $75 for Lambeth lamps. The prices of the Toronto Electric Light Co.'s offer for a renewal of its contract makes it quite probable that the proposition for the city to buy a plant and do its own lighting will be postponed.

BRICK, ROCK, ETC.—Jacksonville, Fla.—Contracts for 75,000 sq. yds. of vitrified paving brick and 204,416 sq. yds. of Alachua rock or Black Creek marl were awarded last week, divided as follows: Bisbee & Foster, Jacksonville, paving in seven streets with Alachua rock, at 40 cts. per sq. yd.; J. E. Bryan, Jacksonville, several streets with Black Creek marl, at 28¾ cts. per sq. yd.; contract for brick divided between Bisbee & Foster for Robbins' paver (made at Robbins, Tenn.), at $1.07⅜ per sq. yd., and the Coaldale Brick & Tile Co., Coaldale, Ala., at 94 cts. for 25,000 sq. yds., 97 cts. for 50,000, or $1 for 75,000; each company to deliver brick as rapidly as possible until both together have delivered 75,000 sq. yds. These prices are higher than those at which contracts were awarded some time ago.

PLANK CURBING.—Jacksonville, Fla.—The following bids have been received for furnishing 134,981 lin. ft. of 3 × 12-in. hard pine or cypress plank curbing: John G. Christopher, heart cypress, $20 per M.; heart pine, $14; Wm. Shetters, cypress, $20; C. W. Hilliard & Sons, yellow pine, merchantable, $10.75; prime, $13.25; Bostwick Lumber Co., pine, $10; cypress, $16; Orange Park Lumber Co., hard pine, $11.50.

HIGHWAYS.—New York, N. Y.—The contract for constructing highways and appurtenances at reservoir D was awarded by the Aqueduct Commissioners Sept. 6 to John Flanagan & Son, Carmel, at $102,765, the bids being as follows:

per lin. ft.; 240 ft. of circular curbing at $2.25; 500 ft. of curbing to be reset at 12 cts.; 70 sq. yds. of granite paving at $4; 12,300 sq. yds. of asphalt at $2.80; 6,370 ft. of gutter flagging at $1.25; 300 sq. yds. of relouldering at 40 cts.; 50 sq. yds. of regranitting at 50 cts.; 400 ft. of gutters to be relaid at 12 cts.; 500 cu. yds. of broken stone at $1.40; total, $51,615.

Chicago, Ill.—The lowest bids received Sept. 22 for paving three streets with asphalt were as follows:

	Paving, per sq.yd.	Curbing, per lin.ft.
La Salle Ave., Trinidad Asphalt Co..	$1.64	$0.51
West Ohio St., A. Jackes	2.07	0.63
St. Louis Ave., Jas. A. W. Pine	2.08	0.47

ASPHALT BLOCK PAVING—Hartford, Conn.—L. W. Burt, ex-Cy. Surv., writes us that the following bids were received Sept. 19 for about 7,500 sq. yds. of paving with asphalt blocks on 6 ins. concrete, in Pearl St.:

M. O'Neil, Hartford, per sq. yd.	$2.76
Hartford, Paving Co., Hartford, per sq. yd.	2.89
Hastings Pavement Co., New York, "	3.15

STONE PAVING.—New York, N. Y.—Contracts were awarded Sept. 14 for paving portions of 46 streets with granite blocks upon 6-in. concrete foundation, with tar and gravel joints. The work will cost about $350,000, and James Pollock received 21 of the contracts, aggregating about $250,000, the others being divided among Wm. P. Baird, John G. Smith, P. H. McCullagh, F. Thilemann, Jr., and Jas. A. Gearty. The largest contract was for the work in Water St., between Whitehall and Rutgers Sts., for which the bids were as follows:

	Paving, 17,650 sq. yds.	New bridge, 10,500 sq. yds.	Con-crete, 2,940 sq. ft.	New curb, 8,500 cu.yds.	lin. ft.	Total.
F. Thilemann, Jr.	$3.05	$0.50	....	$0.50	$64,022	
Wm. P. Baird	2.90	.45	$0.01	.43	60,119	
John G. Smith	3.00	.43	...	.40	61,075	
James Pollock	2.39	.37	.01	.35	49,248	

The time was 200, 150, 60 and 50 days, respectively, for the four bids. For 15,776 sq. yds. of paving in Front St., Messrs. Smith, Baird and Thilemann bid the same as for the Water St. work; Mr. Pollock bid $2.43, 37 cts., 1 ct. and 39 cts., and was awarded the contract, at $45,771, the next bid being $54,791. De Witt C. Bowker, Jr., also bid on this work, his bid being $2.63, 78 cts., $3.20 and 55 cts., respectively, for the paving,

posed paving in Water St. with one course of brick on 6 ins. of concrete was that of Thos. Finane, Port Huron, as follows:

463 cu. yds. earth excavation, at 12 cts.	$55.56
565 cu. yds. block excavation, at 5 cts.	28.15
167 lin. ft. new curb, at 39 cts.	65.13
1,397 lin. ft. curb to reset, at 5 cts.	69.75
3,426 sq. yds. concrete, at 47 cts.	1,610.22
3,426 sq. yds. paving, at $1.07	3,665.82
1 iron catch basin, at $37	37.00
30 ft. sewer, at 15 cts.	4.50
Contingencies	203.09
Total	$5,536.13

The other bids were:

Carlisle & Hull, Port Huron	$7,188 to $7,462
W. F. Ernst, Port Huron	6,806
J. Denler, Port Huron	6,705
M. McArron, Detroit	6,556
Currie & Conn, Detroit	$6,420 and 6,591
Jas. Hanley, Detroit	6,347
Lennane Bros., Detroit	6,208
Kreutzman & Wargosky, Port Huron	$6,083 to 6,254
Talbot Paving Co., Detroit	$5,757 to 5,928

Houston, Tex.—A recommendation of the board of public works that a contract for brick paving be awarded at $2.04 per sq. yd. for a single course of brick has been rejected by the council and a contract awarded at $2.39 per sq. yd. for a double course of brick.

Sunbury, Pa.—A contract for paving with Mack paving brick, with 4-in. Pine Creek curbing, has been awarded to Reed & Co. (J. B. Reed, A. J. Strob and S. L. Garinger), the bids being as follows:

	Paving.	Curb.	Excav.
Hart & Gibbons	$1.75	$1.25	$.30
D. P. Guise	1.65	.65	.25
James McCloud	1.65	.60	.50
Perry & Reeder	1.85	.90	.30
G. W. Keefer	1.68	.62	.30
Reed & Co.	1.56	.68	.15
Lindsay & Van Loon	1.80	.68	.35

De Land, Fla.—The bids for paving the boulevard with brick have been rejected as too high and the work will probably be readvertised. The bids were as follows: Fred Jones & Co., Jacksonville, $1.35 per sq. yd. for the Robbins' paver; I. J. Smith, Jacksonville, $1.22 and $1.43 for the Coaldale brick.

Olean, N. Y.—The contract for paving 2d St., between State and Henley Sts., has been awarded to (3) Homer & Co., Olean, at $3,160 for brick upon a gravel foundation, the other bidders being (1) B. F. Taylor, Olean, and (2) W. E. Warren, Hornellsville. The bids were as follows:

	1.	2.	3.
Excavating, per cu. yd.	$.35	$.25	$.30
Paving, on 6 ins. concrete, per sq. yd.	1.85	1.61	1.59
Curbing, per lin. ft.	.55	.43	.45
Circular corners	.75	.61	.55
Drain tile	.14	.07	.10
Paving, on 8 ins. gravel	1.83	1.47	1.30
Paving, on 8 ins. broken stone	1.85	1.53	1.53

Alliance, O.—The city received nine bids for 4,025 sq. yds. of paving in Market St., with brick, the bids ranging from 56 to 86 cts. per sq. yd. for paving; 28 to 35 cts. per ft. for straight curbing; 33 to 60 cts. for corners; 7 to 24 cts. per ft. for 8-in. drain tile; 5½ to 23 cts. for 6-in.; 18 to 45 for Y's; 15 to 23 cts. per cu. yd. for excavation; 65 to 70 cts. for gravel and sand; 1½ to 2½ cts. per lb. for iron.

Troy, N. Y.—The contract for paving Franklin St., between Ferry and Liberty Sts., with brick has been awarded to P. Callahan, at $2.06½ per sq. yd. for Metropolitan blocks; bridging, 55 cts.; curbing, 78 cts.; old bridging, 18 cts.; old curbing, 18 cts.; repairing catch basin, $38.

Peoria, Ill.—Jacob A. Harman, Cy. Engr., writes us that five contracts for paving with brick have been awarded to J. S. Allen, Peoria, at $1.49 and $1.54 per sq. yd. for paving, 6 cts. for resetting curb, 25 to 30 cts. for excavating and 30 cts. for filling, borrowed material, and one contract to Robt. Clark, Peoria, at $1.52 for paving, 6 cts. for resetting curb and 30 cts. for excavating. The other bidders were Day & Daugherty, Canton, Ill.; Martin McDonald, Peoria; Casgrain & McDonald, Chicago.

CANAL EXCAVATION, ETC.—Chicago, Ill.—The itemized bids received for constructing the first four miles of the eastern section of the Illinois & Mississippi Canal were published in our issue of Sept. 13. The bids for the second four miles were opened Sept. 20 by Capt. W. L. Marshall, U. S. Engr. Office, and recommendations made that contracts be awarded as follows:

Miles 5 and 8 to William F. Callahan at	$14,082
Mile 6 to James Carroll at	6,003
Mile 7 to Kenefick & Strang at	7,837
Lock pit, etc., No. 5, to Coll & McIvor, at	8,011
Lock pits, etc., Nos. 6 and 7, to Heidenrich Co.	18,872

The amount of excavation in mile 5 of the canal is estimated at 139,660 cu. yds., mile 6 at 100,048 cu. yds., mile 7 at 116,110 cu. yds., and mile 8 at 103,147, the bids per cubic yard for this work being as follows:

	Mile. 1.	2.	3.	4.
James Carroll, St. Louis	$0.06	$0.06	$0.18	$0.18
John Killeen, Davenport, Ia.	.10	.11	.12	.12½
Barbour & Ruple, Cleveland	.08 2	...	.11 4	.00 8
M'Donald&P'nfield, Fremont	.09 5	.14	...	.11 8
J.H.Hanson, Princeton, Ill.	.09 9	...	...	...
Kelley&Monroe, P'tsmouth	.09 5	.10	.13	.11⅜
T. F. McManus, Keokuk, Ia	.08½	.07⅜	.07¼	.07½
Robt. Grace, Pittsburg, Pa.	...	.10 95	.14½	...
Jas. Austin, Benton, Ill.	.06	...	...	...
Bick & Glann, Todeio, O.	.11 2	.11 7	.15 4	.14 7
J. J. McCaughey, Summit	.09¾	.07¾	.11½	.10⅞
Conley Bros., Mt. Forrest, Ill.	.08 9	.07 9	.08 9	.10 8
Ed. Phelan, Omaha, Neb.	.07 4	.14	.17	.10
Louis M. Loss, Chicago	.11⅛	.11⅜	.19½	.21½
Bracey Bros., Chicago	.09	.09 6	.10 9	.11 8
W. F. Callahan, Omaha	.0495	.087	.1395	.0695
Kenefick & Strang, Riverside	.06¾	.08½	.09¾	.08¼
Kimbell & Cobb Stone Co.	.08¾	.08 95	.10	.13½

The following submitted bids for constructing the lockpits and foundations, but not for the canal trunk: Manson & Davis, Chicago; John C. Lee, Council Bluffs, Ia.; Coll & McIvor, Marseilles, Ill.; Shaller, Schnglau & Co., Chicago; Heidenrich Co., Chicago; Mall & Doan, Aurora, Ill.; John F. McRoy, Chicago.

Bids Received by Aqueduct Commissioners, New York City, for Constructing Highways at Reservoir D.

Quantities.	Aaron Light & Co., Somers, N. Y.	Hawkes & Stratford, Brooklyn.	J. Flanagan & Son, Carmel, N. Y.	S. J. Peirano & A. A. Cuneo, N. Y.	Cole & Merritt, Carmel, N. Y.	Dougherty & Berrigan, Yonkers.	R. Dooley, New Rochelle.	J. Twinane, N. Y.	Engineer's estimate.
Earth excavation, 50,000 cu. yds.	$0.35	$0.25	$0.20	$0.30	$0.23	$0.30	$0.20	$0.30	$0.28
Rock excavation, 8,000 " "	1.50	1.00	1.25	1.75	.98	1.00	.95	1.50	1.50
Riprap ..... 2,000 " "	1.50	2.00	1.00	1.25	.95	1.50	1.00	1.00	1.50
Rub'l mas. in m'tar, 250 " "	7.25	3.75	4.00	4.00	5.00	4.00	6.00	6.00	4.00
" " dry... 2,000 " "	5.25	2.00	3.00	2.00	2.44	1.75	2.50	2.50	2.50
Split stone mas., 90 " "	9.25	2.25	5.00	4.00	8.00	3.00	3.00	5.00	7.00
Dimen. stone mas., 45 " "	20.00	18.00	15.00	25.00	30.00	25.00	15.00	30.00	25.00
Brick masonry, ...5 " "	12.50	7.50	12.00	9.00	15.00	8.00	10.00	12.00	10.00
Concrete, 5 to 1.....50 " "	8.00	5.25	5.00	4.00	8.00	4.00	5.50	5.00	4.00
*Mas., 2 to 1 extra, 60 " "	1.00	1.20	2.00	1.25	1.40	2.00	6.00	1.00	1.25
Fine hammered (six-cut) face dressing ..... 50 sq. ft.	1.75	.50	1.00	.60	.75	.75	.75	.50	.75
Rough pt. face dress'g.250 " "	1.00	.40	.40	.40	.30	.50	.55	.30	.30
Face work for rubble stone masonry .....1,700 " "	.30	.25	.30	.35	.75	.40	.30	.30	.25
White pine lumber, 5 M. ft. B.M	.055	25.00	30.00	40.00	40.00	30.00	45.00	35.00	35.00
Hemlock lumber, 5 M. ft. B. M.	.045	17.50	30.00	25.00	38.00	25.00	20.00	30.00	25.00
15-in. tile drain pipe 2,000 lin. ft.	.45	.50	1.00	.65	.70	.80	1.00	.90	.80
Stone wall fencing, 87,500 " "	.73	.82	.70	.80	.79	.85	.97	.74	.80
Post rail fencing, painted two coats .....20,000 " "	.15	.50	.40	.20	.19	.18	.20	.20	.25
Total	$115,690	$114,334	$102,765	$114,655	$106,101	$112,947	$119,615	$109,155	$114,517

*Portland cement.

FILLING.—Boston, Mass.—A contract for filling about 120,000 cu. yds. on the South Boston commonwealth flats has been awarded to the New England Dredging Co. at 46 cts. per cu. yd. The material will be taken by dredging from the bar at the mouth of Chelsea Creek, the temporary entrance to the reserved channel on the South Boston flats, and by widening a part of the latter. Chief Engineer Hodgdon, of the harbor and land commission, will supervise the work.

MACADAMIZING.—Newport, R. I.—Contracts have been awarded as follows for macadamizing several roads in the town of Middletown: James Corrigan, Newport, one contract at $1.72½ per ton for crushed stone furnished in place and one contract at $482; Wm. Thurston, Middletown, one at $1.60 per ton and one at $1.85 per ton for crushed stone in place; Charles and J. O. Peckham, Middletown, one at $850.

Dunkirk, N. Y.—J. M. Hackett, Cy. Engr., writes us that the contract for the improvement of fourth section of Central Ave. with telford macadam pavement was awarded Sept. 21 to Jacob Rider, Dunkirk, at $12,335, the bid being as follows:

All excavation, 15 cts. per cu. yd.	$3,706
Pavement complete, $1.19 per sq. yd.	8,800
Curbing, 25 cts. per lin. ft.	3,960
Drain tile, 8 cts. "	3,960

ASPHALT PAVING—Indianapolis, Ind.—Four contracts aggregating about $37,000 were awarded to Hugo Reid, Pres. Trinidad Asphalt Refining Co., New York, last week at prices ranging from $1.70 to $1.75 per sq. yd. This is said to be the lowest price ever bid in this city for such work. The bids were as follows, the price being per lin. ft.:

	Width of streets, ft. 17.75	29.6	37.4	28.9
Warren-Scharf Asphalt Paving Co.	$6.41	$4.60	$5.71	$4.98
Trinidad Asphalt Refining Co.	4.06	2.95	3.65	3.24
Indiana Bermadez Co.	5.66	4.52	5.30	4.60
Western Paving & Supply Co.	4.57	3.74	4.65	4.36

Cincinnati, O.—The contract for paving Court St. with asphalt has been awarded to the Warren-Scharf Asphalt Paving Co. at the following price, according to local papers: 6,200 ft. of 5-in. granite curb at $1.20

bridging, concrete and curbing, making a total bid of $62,975.

Denver, Colo.—The following bids have been received for 21,126 sq. yds. of paving with Colorado sandstone blocks, in 19th St.:

	Cross-P'v'g, sq.yd.	C'b'g, lin.ft.	walks, lin.ft.	D'n pipe, 10-in.	12-in.	Total.
Hugh Murphy	$2.39	$0.92	$0.55	$0.90	$1.00	$61,654
John A. McIntyre	2.47	.80	.61	.75	.80	62,265
P. P. Ford	3.00	.90	.65	1.25	1.31	77,060
J. M. O'Rourke	2.93	1.04	.59	.90	1.00	74,400
John B. Hindry	3.15	.85	.70	.95	1.20	78,339
Charles Connor	2.63	.88	.50	.65	.70	65,982
B. P. Wickham	2.90	.75	.60	.70	.80	71,148

Hugh Murphy, the lowest bidder, is an Omaha contractor, who owns an extensive quarry at Lyons, Colo. The "Republican" states that these prices are considerably lower than have ever been paid before for similar work in Denver. The Blake St. block pavement cost $2.98 per sq. yd. and the curbing on West Larimer St., $1.28 per ft. as against $2.39 and 92 cts. bid by Mr. Murphy for similar work on the proposed 19th St. paving.

Newark, N. J.—The following bids have been received for paving Academy St., from Broad to Plane St., with granite blocks upon a concrete base, with tar and gravel filling:

	Bridging, sq.ft.	Paving, sq.yd.
Terence McManus	$0.38	$2.98
Harper Brothers	.31	3.07
Thomas Bellingham	.40	3.07
New Jersey Asphalt Co.	.45	3.07
P. Reynolds	.40	3.08
J. McGuire	.40	3.16
J. F. Shanley	.47	3.17
Hughes & Flynn	.50	3.25
T. A. O'Connor	.42	3.29
T. J. Reagan	.45	3.29

BRICK PAVING.—Port Huron, Mich.—F. F. Rogers, Cy. Engr., writes us that the lowest bid for the pro-

MACADAMIZING AND PAVING—Kansas City, Mo.—The contracts for macadamizing 20,000 sq. yds. of the Independence boulevard has been awarded to the Kansas City Building & Construction Co., at $1.24 per sq. yd., the macadam to have a top dressing of 3 ins. of Berlin granite. The contract for paving Thirteenth St., from Grand Ave. to Flora, with vitrified brick was awarded to Gray & Ferris, at $1.28 per sq. yd. The Barber Asphalt Paving Co. secured the contract for paving with asphalt Fifth St. from Main to Walnut at $2.63 per sq. yd.

METAL MARKET PRICES.

LEAD.—New York: 3.15 to 3.22 cts. Chicago: 3 cts. St. Louis: 3 to 3.05 cts.

NAILS.—Pittsburg: $1 for wire, and 95 cts. for cut at mill, in carload lots.

BARBED WIRE.—Pittsburg: galvanized, $2 to $2.05; plain, $1.25 for carload lots at mill.

FOUNDRY AND PIG IRON.—New York: $10.50 to $13. Pittsburg: $10.75 to $12. Chicago: $9.50 to $10.50.

TRACK MATERIAL.—New York: angle bars, 1.25 to 1.4 cts.; spikes, 1.5 to 1.7 cts.; track bolts, 2 to 2.1 cts. with square, and 2.1 to 2.3 cts. with hexagon nuts. Chicago: angle bars, 1.25 to 1.35 cts.; spikes, 1.65 to 1.75 cts.; track bolts, 2.1 to 2.2 cts., with hexagon nuts.

RAILS.—New York: $24 at eastern mills and at tidewater; old rails, $11.50 to $12 for iron and $9 to $9.50 for steel; steel rails, fit for relaying, $16 to $19; light rails, $22 to $24; girder rails, $24. Pittsburg: $24 for standard sections. Chicago: $25 to $27; old rails, $11 to $11.25 for iron and $7.50 to $11 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.35 to 1.5 cts.; channels, 1.4 to 1.5 cts.; angles, 1.3 to 1.35 cts.; tees, 1.5 to 1.6 cts.; universal mill plates, 1.25 to 1.35 cts.; steel plates, 1.3 to 1.4 cts. for tank, 1.4 to 1.5 cts. for shell, 1.6 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.25 cts. for locomotive firebox. Pittsburg: beams, 1.25 to 1.35 cts.; channels, 1.25 to 1.35 cts.; angles, 1.15 to 1.25 cts.; tees, 1.4 cts.; universal mill plates, 1.15 to 1.25 cts.; steel plates, 1.2 to 1.25 cts. for tank, 1.3 to 1.4 cts. for shell, 1.35 to 1.45 cts. for flange, 2.5 to 3.5 for ordinary firebox, and 3.35 to 3.5 cts. for locomotive firebox. Chicago: beams, 1.45 to 1.5 cts.; channels, 1.45 to 1.5 cts.; angles, 1.4 to 1.45 cts.; tees, 1.65 cts.; universal plates, 1.4 to 1.45 cts.; steel plates, 1.4 to 1.5 cts. for tank, 1.65 to 2.1 cts. for flange, 1.65 to 5 cts. for firebox.

INDUSTRIAL NOTES.

THE WEST TERRE HAUTE BRICK & SEWER PIPE CO., of Terre Haute, Ind., has commenced the construction of its works.

THE ERIE PAVING CO., of Erie, Pa., had its asphalt works and storehouse destroyed by fire recently, involving a loss of $10,000.

THE AMERICAN BRIDGE & IRON CO., of Roanoke, Va., has resumed operations at its works, which have been shut down for some time.

STEEL WORKS.—Mr. J. P. Witherow, of Pittsburg, proposes to establish steel works at Vancouver, B. C., if the city will assist the project financially.

THE BROOKS LOCOMOTIVE WORKS, Dunkirk, N. Y., have an order from the Illinois Central R. R. for eight express engines with cylinders 18 × 24 ins.

THE ERIE CAR WORKS, of Erie, Pa., were destroyed by fire Sept. 24, involving a loss of about $250,000. The works have only been in partial operation for the past two years.

THE NATIONAL STRUCTURAL TUBING CO., Potter Building, New York, is manufacturing square tubing for use in structural work, and has appointed agents in Chicago, Pittsburg and Philadelphia.

THE LOUIS K. COMSTOCK CO., the Monadnock, Chicago, has the contract for the electric lighting plant for the Chamber of Commerce Building, Detroit, Mich.; also for the lighting system for the P. J. Armour, Jr., Building, Chicago.

THE NATIONAL SWITCH & SIGNAL CO., of Easton, Pa., has recently completed an interlocking plant at East Superior, Wis., at the crossing of the Northwestern Coal Ry. and the Chicago, St. Paul, Minneapolis & Omaha lines.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has the contract for an annealing room building for the Naugatuck Malleable Iron Co., of Naugatuck, Conn. It will be 94 × 175 ft., with brick walls and iron roof trusses covered with corrugated iron.

THE MORGAN ENGINEERING CO., of Alliance, O., has an order from the Metropolitan Elevated Ry. of Chicago, for a 35-ton four-motor electric traveling crane, fitted with auxiliary hoist operated by an independent motor. This crane is for use in the power house.

THE HEINE BOILER CO., of St. Louis, Mo., has recently received the following contracts through its Chicago office, Mgr., J. H. Harris: Fergus Falls, Minn., insane asylum, 110 HP.; Cedar Rapids Electric Light & Power Co., 200 HP.; Deering Harvester Co., Chicago, 1,250-HP.; four boilers for Marquette Bldg., Chicago, and 1,500-HP. for the new electric lighting plant for the city of Chicago.

THE PACIFIC FLUSH TANK CO., 57 Market St., Chicago, Ill., has the contract for furnishing the city of Portsmouth, Va., with 124 Miller siphons for works now in progress. The Miller siphon has also been recently introduced into Denver, Colo.; Leavenworth, Kan.; Boone, Ia.; Peoria, Evanston and Urbana, Ill.; Owosso, Mich.; Indianapolis, Ind.; Dayton, O.; Mansfield, O.; Alliance, O.; Nelsonville, O., and Marietta, O. It has been used exclusively in Omaha, Neb., for the past three years.

THE JOHNSON RAILROAD SIGNAL CO., of Rahway, N. J., has completed the erection of an interlocking plant at Kinder, Ill., where the Madison, Illinois & St. Louis Ry. crosses the Wabash R. R., the Cleveland, Cincinnati, Chicago & St. Louis Ry. and the Chicago & Alton R. R. The machine is the Johnson improved pattern, with interchangeable parts, the frame being arranged for 61 working levers and 7 spare spaces for the operation of 13 switches, 23 switch and lock movements, 3 movable point frogs, 17 facing point locks and 35 signals. This company has also recently completed a 24-lever plant at Huntingdon St. Station, Philadelphia, on the Philadelphia & Reading R. R., and a 12-lever plant at Scranton, Pa., for the Delaware & Hudson Canal Co.

NEW COMPANIES.—Bay State Subway Conduit Co., Portland, Me.; $500,000; subways for electric wires; Pres., Halsey J. Boardman, Boston, Mass.; Treas., E. D. Freeman, Yarmouth, Me.——Baker Oil & Gas Co., Allegheny, Pa.; oil wells; A. C. Dravo, J. T. Patterson and W. W. Campbell, of Pittsburg.——Co-operative Construction & Supply Co., Norwalk, O.; $20,000; D. B. Kuhn, Wm. S. Bayley and W. J. Bowen.——Electric Switch & Trolley Co., Newark, N. J.; Emile Rieser and Jos. A. Campbell, of Newark; Geo. W. Littell, Cranford, N. J.——Euclid Heights Co., Cleveland, O.; $500,000; street railways, water-works, etc.; P. Calhoun, R. R. Conklin and A. J. Thompson.——Rae Building & Contracting Co., San Francisco, Cal.; $250,000, commencing with $625; James Rae, M. J. Ward and M. E. Babb.——Prairie State Construction Co., Chicago, Ill.; $500,000; Hosea W. Bells and E. A. Maynard.——Zenith Gas Engine & Power Co., San Francisco, Cal.; $1,000,000, commencing with $11,000; John W. Eisenholt, Rudolph Herman and Louis F. Durand.——Old Dominion Construction Co., Charleston, W. Va.; $500,000, commencing with $500; G. O. Chilton, B. McDonald and J. A. Thayer.——Arkansas Central Construction Co., Little Rock, Ark.; $500,000; railway construction; Pres., Zeb. Ward; Secy., Howell Jordan.——Goodwin Car Co., Des Moines, Ia.; $2,000,000; Pres., John M. Goodwin; Secy., H. T. Tate, Chicago.——Harris Automatic Air Brake Coupler Co., Spartanburg, S. C.; $1,000,000; Pres., D. R. Duncan; Vice-Pres., S. H. Harris.——Woodland Clay Red Pressed Brick Co., Jonesville, Wis.; $100,000; John W. Carpenter and George L. Chittenden.——Kansas City Paving Co., Kansas City, Mo., $50,000; G. M. Venable, E. H. Bradbury and Geo. W. Horwell.

MUNICIPAL BOND MARKET.

New York, Sept. 25, 1894.

The end of the financial month is accompanied as usual by a slackening off in the amount of business done, and the market for municipal bonds continues, therefore, to be depressed by the factors commented upon in last week's contribution to these columns. In making use of the word "depressed," however, there is no intention to convey the impression that any decline in prices has as yet attended the relaxation in activity noticeable during the past few weeks. The falling off in the volume of business is still unaccompanied by any slump in values, which, in fact, are firmly held for all classes of investment bonds and dividend-paying stocks. But this strength is particularly marked in municipal bonds. As the situation stands, holders of these securities show no disposition to part with them at current figures, while, on the other hand, investors and institutions seem disinclined to advance their bids. Consequently the market remains restricted, but the feeling favors an improvement in prices.

As bearing on another phase of the municipal bond market, it may be well to repeat at this juncture what N. W. Harris & Co., the prominent brokers of New York, Boston and Chicago, have to say. They note that, "on the Pacific coast and in the Mississippi Valley, a large proportion of recent proposed issues of bonds have been voted down by the people; while, in the Eastern and Middle States, the tendency has been to take advantage of labor and materials for public improvements, and of the low rates for money, by putting out new bond issues of unusual number and magnitude. At the present writing, however, the aggregate amount of new issues in sight is much less than is usual at this season, and in view of the lessened supply of municipal securities and the uncertainty regarding the net earnings of most of the larger corporate enterprises of the country, we believe that we must look for a continued advance for two or three years, at least, in the market value of extra high grade bonds." These expert opinions carry out rather fully prognostications heretofore made in these letters, that new municipal issues will be scarce, and that good issues already in existence must in the nearby future command much appreciated values.

There are few recent bond sales of importance. Some excitement attended the disposal of the $150,000 Lexington, Ky., 4½ per cent, 1 to 10-year and 40-year bonds. On the first sale Rudolph Kleybolte & Co. of Cincinnati, O., bid 103.266 for the issue, but, after it had been accepted by the ways and means committee of the municipality, the firm withdrew its bid without furnishing any reason. On the second sale F. H. Rollins & Sons, of Boston, offered 102.783, and were awarded the issue. This is rather a good price, but it does not compare with the figures obtained by the town of Manchester, N. H., which sold $50,000 4 per cent. 20-year water loan bonds to N. W. Harris & Co. at 104.79, no bids being below 103.08. By way of contrast, Flushing, N. Y., 25-year refunding bonds bearing the same rate of interest were sold this week at but 100.81, N. W. Harris & Co. being the purchasers also in this instance. These examples will serve to show the trend of the market. As furnishing, however, to contractors and other interested parties some indication as to the credit enjoyed by other municipalities and townships, the following table of current offerings is appended:

MUNICIPAL BONDS.

	Price.
City of Brainerd, Minn., School District 6s	107⅜
County of Brazoria, Tex., Court House, 6s	103¼
Spokane County, Wash., School District 6s	104⅜
St. James, Minn., Water Works 6s	107⅜
Balar County, Tex., Court House 6s	107⅜
Park County, Mont., Funding 6s	109¼
City of Tracy, Minn., Funding 6s	104⅜
City of Pueblo, Col., Gen. Fund. 6s	104⅜
County of Flathead, Mont., 6s	107⅝
City of Bartow, Fla., 6s	102
City of Pana, Ill., Water 6s	105½
City of Chicago, Drainage 5s, 1895	100⅜
" " 5s, 1914	107⅜
Otter Tail County, Minn., Ref. 5s	105
City of Omaha, Neb., City Park 5s	111
Marseilles, Ill., School 5s	102⅛
City of Galveston, Tex., Water Works 5s	101½
City of Portland, Ore., Water 5s	112½
City of Parkersburg, W. Va., 5s	102
City of Cheboygan Mich., Water 5s	103¼
City of Salt Lake, Utah, Gen. Fund. 5s	103¼
City of Tacoma, Wash., Water 5s	102
Asbury Park, N. J., Water 5s	108
City of East Liverpool, O., School 5s	108¼
Methuen, Mass, Water 4s	1
City of Derby, Conn., Funding 4s	102½
City of Denver, Colo., Public Impvt. 4s	100
City of Brooklyn Water Loan, 4s	107⅜
" " " Sewer Loan, 4s	109⅜

RAILWAY STOCK MARKET.

New York, Sept. 25, 1894.

Wall Street is again gloomily disposed, and this time it is worrying about the outlook for traffic, Western railway men in particular being disposed to take an exaggerated view of the bad features of the situation. The Grangers have been the markedly weak feature of the railway stock market, and the whole railway list has been constrained to sympathize in their weakness. It must be admitted that the railway earnings of roads running into Chicago will, from now on until November, compare most unfavorably with the earnings during the same period last year, but it is apparently forgotten by the bears, who love to dwell at length on this showing, that the favorable earnings at this time last year were principally due to the tremendous traffic caused by the World's Fair, and do not, therefore, afford a just standard of comparison. On the other hand, last week's record of eastbound shipments from Chicago do not indicate that the trunk lines will suffer from lack of traffic this fall. Last week there were 52,427 tons sent east, as against 51,528 tons sent the week previous, and 48,206 tons for the corresponding week a year ago. That business is beginning to assume fair proportions is moreover indicated by the record of lake shipments, which last week were 62,086 tons against 58,551 for the previous week.

The cutting in half of the Rock Island quarterly dividend—from 1 to ½ per cent.—has been chiefly instrumental in neutralizing the good feeling brought about by the declaration of the regular 2 per cent. semi-annual dividend by the St. Paul road. It is known that the Rock Island policy is to declare only earned dividends, and the reduction by one-half is an open confession that the past year was disastrous to its earnings. In such a case the action taken was conservative and proper, as the danger of paying unearned dividends from surplus account has been demonstrated time and time again. Wall Street had been led to believe, however, from the good showing made by the St. Paul's annual report that most of the prominent railways had managed to weather the hard times unscathed, and so the Rock Island episode is a big disappointment. So far as future dividends are concerned, Eastern directors tell their friends that they will be determined by the current earnings and not by the condition of the treasury.

New York Central has again become a target for bear attack, the advent of the dividend period leading to renewed doubts as to the certainty of continued payments at the current rate of 1¼ per cent. quarterly. The buying of the stock of recent days, however, has been of a character to denote that those well-informed believe that the present rate will be maintained. The question will be settled at the directors' meeting towards the end of this week. It is most likely that the current rate will be maintained, as that will do a great deal towards inducing an easier feeling abroad as regards American securities and strengthening quotations at home. Even if the dividend is cut, it must be borne in mind that the New York Central, by reason of its exemption in this state from taxation, has sold at present prices even on a 4-per cent. basis.

Another blow to Wall Street is the provision of the Reading reorganization plan just promulgated for a 10-per cent. subscription by income bondholders, as well as stockholders, to the new collateral trust bonds. The income bonds have been the main sufferers all along by reason of the reckless policy of the Reading's various managements, and the already expressed determination to withstand what is really extortion will find many ardent supporters.

At present sentiment is bearish, but this has so far only resulted in creating a tremendous short interest that will soon have to contend with a decided upward tendency.

RAILWAY STOCK MARKET.

Railway stocks.	Closing prices Sept. 25.
Alton & Terre Haute	31
Atchison, Topeka & Santa Fe	7
Baltimore & Ohio	76½
Canada Southern	51½
Chesapeake & Ohio	20½
Chicago, Burlington & Quincy	78½
Chicago & Northwestern	102½
Chicago, Milwaukee & St. Paul	65½
Chicago, Rock Island & Pacific	61½
Cleveland, Cincinnati, Chicago & St. Louis	39½
Delaware, Lackawanna & Western	169½
Delaware & Hudson	135
Hocking Valley	19
Illinois Central	93
Lake Shore & Michigan Southern	134½
Louisville & Nashville	56¾
Missouri Pacific	28⅝
Missouri, Kansas & Texas	14⅝
Mobile & Ohio	19½
New Jersey Central	112
New York Central	100
New York & New England, 3d asst. pd	32½
New York, New Haven & Hartford	178
New York, Chicago & St. Louis, 1st pfd	65
New York, Lake Erie & Western	15⅜
New York, Ontario & Western	17
New York, Susquehanna & Western	16⅞
Northern Pacific	4¾
Northern Pacific, pfd	25
Philadelphia & Reading	19½
Richmond Terminal	18¾
St. Paul & Omaha	35½
Southern Pacific	20¼
Texas Pacific	9⅞
Union Pacific	12
Wabash pfd	14⅞
Wheeling & Lake Erie	12⅞

BOSTON RAILWAY STOCKS.

	Sept. 25.
Boston & Albany	206½
Boston & Maine	154
Fitchburg, pfd	77
Old Colony	178

PHILADELPHIA RAILWAY STOCKS.

	Sept. 25.
Lehigh Valley	37½
Pennsylvania Railroad	51⅝

PROPOSALS FOR SEWER PIPES.

RECORDER'S OFFICE,
CITY OF JACKSONVILLE, Fla.,
September 14, 1894.

Sealed proposals will be received by the Board of Public Works of the city of Jacksonville, Fla., until Wednesday, October 10, 1894, at 3:30 o'clock, for supplying free on board at Jacksonville, Fla., not less than 200,000 feet of sewer pipe and "specials," not less than 60,000 feet to be delivered before November 1, 1894, and not less than 60,000 feet during each of the months of November and December, 1894; with a further delivery of such amounts as may be ordered one month in advance, not to exceed 60,000 feet each in January, February and March, 1895; the whole amount not to exceed 360,000 feet of all sizes.

The probable amount of each size required in the first 200,000 feet will be as follows:

6-inch, between 50,000 and 100,000 feet; 8-inch, between 75,000 and 125,000 feet; 10-inch, between 15,000 and 30,000 feet; 12-inch, between 10,000 and 25,000 feet; 15-inch, between 10,000 and 25,000 feet.

In the further deliveries the sizes will be within the limits of 6 and 16-inch, and the proportions will probably be similar to those above given.

The first 60,000 feet to be delivered November 1 is to be made up as follows:

6-inch, 15,000 feet; 8-inch, 35,000 feet; 10-inch, 5,000 feet; 12-inch, 5,000 feet; 15-inch, 5,000 feet.

All pipe and "specials" will be closely inspected as unloaded, and every piece not fully up to the highest standard of Ohio pipe and to all the requirements of specifications will be rejected. All pipe rejected must be taken possession of forthwith by the seller.

All pipe accepted will be paid for in cash within 30 days after acceptance.

All proposals to be marked "Bids for Sewer Pipe." The Board of Public Works reserves the right to reject any or all bids. For copies of specifications and other information address

38-3t WM. C. WEST, Recorder,
Secretary Board of Public Works.

PROPOSALS FOR VERTICAL COMPOUND PUMPING ENGINES.

OFFICE OF THE
DEPARTMENT OF PUBLIC WORKS,
CHICAGO, Sept. 8, 1894.

Sealed proposals will be received by the city of Chicago until 11 a. m. Thursday, Oct. 11, 1894, for two vertical compound pumping engines, each engine having a capacity of 15,000,000 U. S. gallons of water in 24 hours, with the necessary boilers and all appurtenances ready for daily use, to be erected at the Chicago avenue pumping station, in the city of Chicago.

According to plans and specifications on file in the office of the Department of Public Works of said city.

Proposals must be made out upon blanks furnished at said office and be addressed to said department, indorsed "Proposals for Vertical Compound Pumping Engines," and be accompanied with $5,000 in money or a certified check for the same amount on some responsible bank doing business in the city of Chicago and made payable to the order of the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications provided such contract should be awarded to him.

Companies or firms bidding will give the individual names as well as the name of the firm, with their address. H. J. JONES,

37-3t Commissioner of Public Works.

LAND RECLAMATION, ISLIP, L. I.

Sealed bids are invited until 12 o'clock noon, Oct. 5, 1894, for the filling—for the purpose of reclaiming—about 77½ acres of salt marsh land on the Great South Bay, at Islip, Suffolk Co., N. Y. The filling material is principally sand and gravel to be taken from the bay adjoining, and from a canal to be excavated through the property.

The level of the finished area at completion is to be three (3) feet above present level of marsh. The amount of bid to be the price per acre of finished area.

Map and specification may be seen at the office of Eugene R. Smith, Civil Engineer, Islip, Suffolk County, N. Y., where any further information may be obtained. The right is reserved to reject any or all bids.

Bids should be indorsed "Proposal for Land Reclamation," and addressed to

EUGENE R. SMITH,
Engineer in Charge,
38-2t Islip, Suffolk County, N. Y.

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NOTICE.

Sealed proposals, for constructing a dam, a retaining wall and a pump pit together with foundation piers for vertical pump, will be received at the office of the undersigned until 6 o'clock p. m., Wednesday, October 3d, 1894.

Plans and specifications can be seen at the office of the undersigned. Specifications and forms of proposal will be furnished upon application. Each proposal must be accompanied by a certified check for 5 per cent. of the amount of proposal.

The right to reject any or all bids is reserved by the city.

Proposals must be inclosed in envelopes sealed and marked "Proposal for New Water Supply," and addressed to the Board of Water Commissioners, care of R. W. Havens, City Engineer, Dallas, Texas.

R. W. HAVENS,
City Engineer.
Dallas, Texas, Sept. 3d, 1894. 37-3t

NOTICE.

The City Council of Cynthiana, Ky., will receive sealed bids until 12 M. noon, local time, on the second Tuesday in October, 1894, for furnishing the said city with not less than 25 arc lights of 1,200 nominal candle power each, and not less than 40 incandescent lights of not less than 24 candle power each. All bids shall be sealed and delivered to the clerk.

38-2t L. S. WILLIAMS, City Clerk.

NOTICE TO CONTRACTORS.

CAZENOVIA, N. Y., SEWERAGE SYSTEM.

Notice is hereby given that sealed proposals will be received by the Board of Sewer Commissioners of the village of Cazenovia until twelve o'clock noon of the third day of October, 1894, for the furnishing of the material and labor for the construction of about seven miles of sewers, complete, as per specifications.

Each proposal for said work must be accompanied by a certified check for $250 on some banking institution in good standing, said check to be made payable to the order of the President of the Board of Sewer Commissioners of the village of Cazenovia as a guaranty. Bids for the material and labor must be made separately.

The map, profiles and detailed drawings of the proposed system may be seen at the office of the President of the Board, in the village of Cazenovia, and copies of the contract, specifications and proposal may be obtained by application by mail or otherwise to J. A. Loyster, Clerk of the Board of Sewer Commissioners, Cazenovia, N. Y.

Bids must be sealed and addressed to J. A. Loyster, Clerk of the Board of Sewer Commissioners, Cazenovia, N. Y.

JOHN W. HOWSON, President.
J. A. LOYSTER, Clerk.
Dated Cazenovia, N. Y., Sept. 19, 1894. 38-2t

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For circulars and information write to

STANDARD GAUGE CO., No. 24 Haven Bldg., Buffalo, N. Y.

PROPOSALS FOR HORIZONTAL PUMPING ENGINES.

OFFICE OF THE
DEPARTMENT OF PUBLIC WORKS,
CHICAGO Sept. 8th, 1894.

Sealed proposals will be received by the city of Chicago until 11 a. m. Thursday, Oct. 11, 1894, for two horizontal compound condensing pumping engines, each engine having a capacity of 14,000,000 U. S. gallons of water in twenty four hours, with the necessary boilers and all appurtenances ready for daily use, one engine to be erected at the Sixty-eighth street pumping station and one engine to be erected at the Lake View pumping station, in the city of Chicago.

According to plans and specifications on file in the office of the Department of Public Works in said city.

Proposals must be made out upon blanks furnished at said office, and be addressed to said department, indorsed "Proposals for Horizontal Pumping Engines," and be accompanied with $4,000 in money or a certified check for the same amount on some responsible bank doing business in the city of Chicago and made payable to the order of the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names as well as the name of the firm, with their address. H. J. JONES,

37-3t Commissioner of Public Works.

PROPOSALS FOR TRIPLE EXPANSION PUMPING ENGINE, FOURTEENTH STREET WORKS.

OFFICE OF THE
DEPARTMENT OF PUBLIC WORKS,
CHICAGO, Sept. 8, 1894.

Sealed proposals will be received by the city of Chicago until 11 a. m. Thursday, October 11, 1894, for one triple expansion pumping engine of a capacity of 30,000,000 U. S. gallons of water per day of 24 hours, with the necessary boilers and all appurtenances ready for daily use, to be erected at the Fourteenth street pumping station in the city of Chicago.

According to plans and specifications on file in the office of the Department of Public Works of said city.

Proposals must be made out upon blanks furnished at said office and be addressed to said department, indorsed "Proposals for Triple Expansion Pumping Engine, Fourteenth Street Works," and be accompanied with $5,000 in money or a certified check for the same amount on some responsible bank doing business in the city of Chicago and made payable to the order of the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names as well as the name of the firm, with their address. H. J. JONES,

37-3t Commissioner of Public Works.

PROPOSALS FOR SEWERS.

CONNERSVILLE, IND.

Sealed proposals for constructing sewers in the City of Connersville, Indiana, will be received at the office of City Clerk of Connersville until 10 o'clock A. M., October 2d, 1894.

The approximate quantities are as follows:

3,500 feet of 18 inch double strength pipe sewer.
625 feet of 15 inch pipe sewer.
1,650 " " 12 " " "
1,300 " " 8 " " "
3,500 " " 6 " " "
170 " " 18 " cast iron pipe outlet.

Manholes, lampholes, flush tanks, etc.

Plans, specifications and blank forms are on file at the office of City Clerk of Connersville, also at the office of John A. Cole, Consulting Engineer, 1580 Old Colony Building, Chicago, Ill.

W. F. McNAUGHTON,
City Clerk,
38-2t Connersville, Ind.

For Other Proposals See P. XVI

SEALED PROPOSALS

Will be received by the Building Committee of Beaver Falls, Pa., Council, until 3 o'clock p. m. of Tuesday, October 2d, as follows:

For 2,800 tons cast iron water pipe and special castings.

For 230 fire hydrants.

For 205 valves and valve boxes.

For the laying of 20 miles of 4 to 16-in. pipe.

For the sinking of a sufficient number of tubular wells to obtain a 6,000,000 gallon supply of water.

Also, at 3 p. m. of October 16th, for two 3,000,000 gallon pumps, and for the building of a 6,000,000 gallon reservoir.

Also, at 3 p. m. of November 6th, a complete filtering plant, with a capacity of 3,000,000 gallons in 24 hours, and buildings to contain the pumps, boilers and filtering plant.

Plans may be seen and detail specifications for the above-mentioned work and material can be obtained of the Borough Clerk, W. W Kerr, and also at the office of the engineers, James H. Harlow & Co., Times Building, Pittsburg, Pa., and Wilkinsburg, Pa., two weeks previous to the above dates.

At the time and dates above mentioned the several proposals will be received and publicly opened and read. A certified check will be required of bidders.

The right is reserved to reject any or all bids.

SAMUEL CREESE, Chairman;
H. F. DILLON,
L. S. LUTTON,
A. O. MEYERS,
37-3t TITUS WELSH,
Building Committee.

JAMES H. HARLOW & CO., Engineers.

TO WATER-WORKS CONTRACTORS.

Sealed proposals will be received at the office of B. F. Earl, Chairman of Committee on Water Supply of Niles, Berrian County, Michigan, until 7 o'clock p. m. on Tuesday, the 2d of October, 1894, for the construction of a system of water-works for said city.

Plans and specifications will be on file at the office of said Chairman of Committee, also at the office of the Consulting Engineer, Geo. W. Sturtevant, Jr., No. 804 Chamber of Commerce Building, Chicago, Ill., on and after September 18th, 1894.

Each proposal must be sealed, addressed to the Chairman of the Committee, Niles, Michigan, marked "Proposals for Water-Works Construction," and have inclosed a certified check payable to the City Treasurer, Niles, Michigan, for the sum of one thousand (1,000) dollars, as a guaranty that the bidder will enter into a contract for the construction of said works and furnish bonds within five days from date of award.

The city reserves the right to reject any or all bids.

Dated at Niles, Michigan, Sept. 7, 1894.

B. F. EARL, Chairman;
E. S. WILLIAMS,
C. RADEWALD,
38-2t A. F. BITHER,
Committee on Water Supply.

NOTICE TO CONTRACTORS.

Ten months' work on the Jaqui Canal, in Sonora, Mexico; the finest kind of material to handle; nearly 1,000,000 cubic meters to move; clearing and grubbing all done. To look at work, go to Guaymas, Mex., take boat from there to Medano. Notify French & Reed, at Cocorit, when you leave Guaymas; they will meet you with team at Medano. Communicate with FRENCH & REED, Cocorit, Mex., or 205 New High street, Los Angeles, Cal.

37-6t

PROPOSALS FOR FURNISHING SEWER PIPE AND INVERT BLOCKS.

Office of the Commissioners,
Washington, D. C., Sept. 29, 1894.

Sealed proposals will be received at this office until 2 P. M., Oct. 13, 1894, for furnishing and delivering sewer pipe and invert blocks. Specifications and blank forms of proposals may be obtained at this office. J. W. Ross, George Truesdell, C. F. Powell, Commissioners D. C. 39-2t

PROPOSALS FOR MODEL BARGES, U. S. Engineer Office, Room 430, Custom House, St. Louis, Mo., Sept. 24, 1894.—Sealed proposals, in duplicate, for furnishing 12 model barges will be received here until 12 M., Oct. 24, 1894, and then publicly opened. All information furnished on application. CHAS. J. ALLEN, Major Engrs. 39-3t

U. S. ENGINEER OFFICE, ARMY BUILDing, New York, Sept. 13, 1894.—Sealed proposals for dredging channels in Raritan Bay, N. J., will be received here until 12 m., Oct. 15, 1894, and then publicly opened. All information furnished on application. ROBERT McGREGOR, Second Lieut. Engrs. 39-3t

TREASURY DEPARTMENT, OFFICE SUpervising Architect, Washington, D. C., September 15, 1894.—Sealed proposals will be received at this office until 2 o'clock P. M. on the 12th day of October, 1894, and opened immediately thereafter, for all the labor and materials required for the excavation, foundations, basement and area walls, basement columns and I beams, etc., of first floor construction, temporary drainage, etc., for the United States Post Office building at Allegheny, Pa., in accordance with the drawings and specifications, copies of which may be had at this office, or the office of the Superintendent at Allegheny, Pa. Each bid must be accompanied by a certified check for a sum not less than two per cent. of the amount of the proposal. The right is reserved to reject any and all bids, and to waive any defect or informality in any bid, should it be deemed in the interest of the Government to do so. All proposals received after the time stated will be returned to the bidders. Proposals must be inclosed in envelopes sealed and marked "Proposal for the Excavation, Foundations, Etc., for the United States Post Office Building at Allegheny, Penn.," and addressed to JEREMIAH O'ROURKE, Supervising Architect. 38-2t

TREASURY DEPARTMENT, Office Supervising Architect, Washington, D. C., Sept. 25, 1894.—Sealed proposals will be received at this office until 2 o'clock p. m. on the 24th day of October, 1894, and opened immediately thereafter, for removing the old steam-heating apparatus and to furnish all the labor and materials and fix in place complete the low-pressure, return-circulation, steam-heating and ventilating apparatus for the U. S. Custom House and Post Office building at New Haven, Conn., in accordance with the drawings and specification, copies of which may be had at this office, or the office of the custodian at New Haven, Conn. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The right is reserved to reject any or all bids and to waive any defect or informality in any bid, if it be deemed in the interest of the Government to do so. All proposals received after the time stated will be returned to the bidders. Proposals must be inclosed in envelopes, sealed and marked "Proposal for Removing Old and Constructing New Heating and Ventilating Apparatus for the U. S. Custom House and Post Office Building at New Haven, Conn.," and addressed to CHARLES E. KEMPER, Acting Supervising Architect. 39-2t

TREASURY DEPARTMENT, Office Supervising Architect, Washington, D. C., September 25, 1894.—Sealed proposals will be received at this office until 2 o'clock P. M. on the 23d day of October, 1894, and opened immediately thereafter, for all the labor and materials required for the approaches, etc., for the U. S. Court House and Post Office at Detroit, Mich., including all the stone and brickwork required for the Wayne and Shelby Street entrances in accordance with drawings and specification, copies of which may be had at this office or the office of the Superintendent at Detroit, Mich. Each bid must be accompanied by a certified check for a sum not less than 2 per cent. of the amount of the proposal. The right is reserved to reject any or all bids, and to waive any defect or informality in any bid, should it be deemed in the interest of the Government to do so. All bids received after the time stated will be returned to the bidders. Proposals must be inclosed in envelopes, sealed and marked "Proposal for Approaches, Etc., for the U. S. Court House and Post Office at Detroit, Michigan," and addressed to CHARLES V. KEMPER, Acting Supervising Architect. 39-2t

U. S. ENGINEER OFFICE, ROOM H 7, 39 Whitehall St., New York City, Sept. 24, 1894.—Sealed proposals for construction of breakwaters at Duck Island Harbor, New Haven Harbor, mouth of Housatonic River, Conn., and Glen Cove Harbor, N. Y., will be received here until 12 o'clock noon, Tuesday, Oct. 16, 1894, and then publicly opened. All information furnished on application. HENRY M. ROBERT, Lieut.-Col. Engrs. 39-3t

U. S. ENGINEER OFFICE, ST. AUGUSTine, Fla., Sept. 25, 1894.—Sealed proposals, in duplicate, will be received at this office until 12 o'clock noon, Oct. 25, 1894, and then publicly opened, for delivering 10,000 tons, more or less, of granite or other hard and durable rock upon the jetty at the northwest entrance to Key West Harbor, Fla. All information will be furnished on application to this office. THOS. H. HANDBURY, Major Corps of Engrs, U. S. A. 39-4t

U. S. ENGINEER OFFICE, NORFOLK, Va., Sept. 11, 1894.—Sealed proposals for dredging in harbor at Norfolk, and its approaches, Virginia, will be received at this office until 12 o'clock, noon, Oct. 11, 1894, and then publicly opened. All information will be furnished on application to this office. EDWARD BURR, First Lieut. Corps of Engineers, U. S. A. 37-4t

U. S. ENGINEER OFFICE, NORFOLK, Va., Sept. 11, 1894.—Sealed proposals for dredging in Nansemond River, Va., will be received at this office until 12 o'clock noon, Oct. 11, 1894, and then publicly opened. All information will be furnished on application to this office. EDWARD BURR, First Lieut. Corps of Engineers, U. S. A. 37-4t

U. S. ENGINEER OFFICE, 601 EIGHteenth St., N. W., Washington, D. C., Sept. 4, 1894.—Sealed proposals for furnishing building stone, riprap stone, and for dredging in Potomac River, will be received here until 12 M. Thursday, October 4, 1894, and then publicly opened. All information furnished on application. CHAS. E. L. B. DAVIS, Major Engrs. 36-4t

U. S. ENGINEER OFFICE, 601 EIGHteenth Street, N. W., Washington, D. C., Sept. 17, 1894.—Sealed proposals for dredging in Occoquan and Aquia Creeks, Va., will be received here until 12 M., Wednesday Oct. 17, 1894, and then publicly opened. All information furnished on application. CHAS. E. L. B. Davis, Major Engrs. 38-4t

U. S. ENGINEER OFFICE, ROOM H 7, 39 Whitehall St., New York City, Sept. 24, 1894.—Sealed proposals for dredging in Mystic River, New Haven Harbor, Norwalk Harbor, Conn., and East Chester Creek, N. Y., will be received here until 12 o'clock noon, Tuesday, Oct. 16, 1894, and then publicly opened. All information furnished on application. HENRY M. ROBERT, Lieut.-Col. Engrs. 39-3t

U. S. ENGINEER OFFICE, 366 MILWAUkee St., Milwaukee, Wis., Sept. 20, 1894.—Sealed proposals for Milwaukee Harbor, Wis., dredging 30 000 cu. yds., more or less, will be received here until 12 o'clock noon, Oct. 3, 1894, and then publicly opened. All information furnished on application. JAMES F. GREGORY, Major Engrs. 39-4t

U. S. ENGINEER OFFICE, 121 Franklin St., Buffalo, N. Y., Sept. 14, 1894.—Sealed proposals will be received at this office until 2 p. m., Oct. 15, 1894, and then publicly opened for the hire of dredging plant; including a submarine drill boat; for use on the Niagara River, between Tonawanda and Port Day. For information apply to Major E. H. RUFFNER, Corps of Engineers. 38-3t

U. S. ENGINEER OFFICE, ARMY BUILDing, New York, Sept. 10, 1894.—Sealed proposals for dredging Red Hook Shoal, in Buttermilk Channel, New York, will be received here until 12 M., Oct. 11, 1894, and then publicly opened. All information will be furnished on application. ROBERT McGREGOR, 2d Lieut., Corps of Engrs. 38-4t

U. S. ENGINEER OFFICE, 9 PLEASANT Street, Baltimore, Md., Sept. 11, 1894.—Sealed proposals for dredging in the Ship Channel leading to the harbor of Baltimore will be received until noon of October 11, 1894, and then opened. For information apply to WILLIAM P. CRAIGHILL, Colonel Corps of Engineers, U. S. A. 38-3t

U. S. ENGINEER OFFICE, 601 EIGHteenth street N. W., Washington, D. C., Sept. 17, 1894.—Sealed proposals for furnishing riprap stone at Occoquan Creek, Va., will be received here until 12 M. Wednesday, October 17, 1894, and then publicly opened. All information furnished on application. CHAS. E. L. B. DAVIS, Major Engineers. 38-4t

U. S. ENGINEER OFFICE, 601 EIGHteenth St., N. W., Washington, D. C., Sept. 4, 1894.—Sealed proposals for dredging in York River, Va., will be received here until 12 m. Thursday, Oct. 4, 1894, and then publicly opened. All information furnished on application. CHAS. E. L. B. DAVIS, Major Engrs. 34-4t

U. S. ENGINEER OFFICE, 601 EIGHTeenth St. N. W., Washington, D. C., Sept. 4, 1894.—Sealed proposals for dredging at Nomini and Lower Machodoc Creeks, Va., will be received here until 12 M., Thursday, October 4, 1894, and then publicly opened. All information furnished on application. CHAS. E. L. B. DAVIS, Major Engrs. 36-4t

U. S. ENGINEER OFFICE, BURLINGTON, Vt., Sept. 5, 1894.—Sealed proposals in triplicate, for dredging in Great Chazy River, N. Y., will be received here until 2 P. M., Oct. 5, 1894, and then publicly opened. Full information furnished on application to SMITH S. LEACH, Captain Engineers. 36-4t

U. S. ENGINEER OFFICE, BURLINGTON, Vt., Sept. 5, 1894.—Sealed proposals in triplicate, for rock excavation in Otter Creek, Vt., will be received here until 2 P. M., Oct. 5, 1894, and then publicly opened. Full information furnished on application to SMITH S. LEACH, Captain Engineers. 36-4t

U. S. ENGINEER OFFICE, BOSTON, Mass., Sept. 8, 1894.—Sealed proposals for dredging in Weymouth River, Mass., will be received here until noon, Oct. 8, 1894, and then publicly opened. All information furnished on application. S. M. MANSFIELD, Lieut. Col. Eng'rs. 37-3t

U. S. ENGINEER OFFICE, BURLINGton, Vt., Sept. 5, 1894.—Sealed proposals in triplicate for repairs to Burlington Breakwater, Vt., will be received here until 2 P. M., Oct. 5, 1894, and then publicly opened. Full information furnished on application to SMITH S. LEACH, Captain Engineers. 36-4t

U. S. ENGINEER OFFICE BURLINGTON, Vt., Sept. 5, 1894.—Sealed proposals in triplicate for dredging in Ogdensburg Harbor, N. Y., will be received here until 2 P. M., Oct. 5, 1894, and then publicly opened. Full information furnished on application to SMITH S. LEACH, Captain Engineers. 36-4t

U. S. ENGINEER OFFICE Savannah, Ga., Aug. 29, 1894.—Sealed proposals for constructing jetties at Cumberland Sound, Ga., will be received here until 12 M., city time, Sept. 29, 1894, and then publicly opened. All information furnished on application. O. M. CARTER, Capt. Corps of Engrs. 37-3t

U. S. ENGINEER OFFICE, BOSTON, Mass., Sept. 8, 1894.—Sealed proposals for the delivery of rubble stone at Scituate Harbor, Mass., will be received here until noon, Oct. 8, 1894, and then publicly opened. All information furnished on application. S. M. MANSFIELD, Lieut.-Col. Eng'rs 37-3t

U. S. ENGINEER OFFICE, BOSTON, Mass., Sept. 22, 1894.—Sealed proposals for Removal of Ledges from Boston Harbor, Mass., will be received here until noon Oct. 22, 1894, and then publicly opened. All information furnished on application. S. M. MANSFIELD, Lieut.-Col. Engrs. 39-3t

U. S. ENGINEER OFFICE, 537 CONGRESS street, Portland, Me., Sept. 14, 1894.—Sealed proposals for dredging in Back Cove, Portland Harbor, Me., will be received here until 3 P. M., Monday, Oct. 15, 1894, and then publicly opened. All information furnished on application to PETER C. HAINS, Lieut. Col. Engrs. 39-3t

NOTICE TO CONTRACTORS.

Notice is hereby given that on Tuesday, October 9th, 1894, the County Commissioners of Marion County, Ohio, will sell at public outcry the construction of the Columbia Street County Ditch Improvement as an entirety which shall include the price for all material, labor, etc., used in the construction of said ditch according to the map, profile, plans, specifications and detail drawings on file in the Auditor's office of Marion County, Ohio. The contract will be awarded to the lowest responsible bidder to complete said improvement as above specified. Sale to take place on the line of said improvement.

The Columbia Street County Ditch Improvement is in general as follows:

9,356 lin. ft. of open ditch					
3 397	"	"	6½ ft.	brick arch.	
2,203	"	"	5½ "	"	"
2,022	"	"	4½ "	"	"
2,888	"	"	3½ "	"	"
1.085	"	"	3 "	"	"
615	"	"	2 "	double strength	sewer pipe.

No bids will be received unless the bidder has deposited with the Auditor of Marion County, Ohio, a certified check in the sum of $500.00, said check to be in evidence that the bids are made in good faith, and that the successful bidder will within five days after the award is made enter into a contract with and give bond to the County of Marion, State of Ohio. The successful bidder will be required to give bond in the sum of double the estimated value of the construction of said improvement; said bonds to be approved by the Commissioners of Marion County, Ohio.

B. J. Hill, the constructing engineer who made the apportionment of said improvement as directed, to superintend and conduct such sale.

The contract price will be paid in cash on estimates as provided for by law.

By order of the Commissioners of Marion county, Ohio.

Copy of specifications sent upon request.

U. K. GUTHERY,
County Auditor.
H. J. HILL,
Constructing Engineer.
MARION, O., Sept. 18, 1894. 39-2t

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The transatlantic record has again been lowered by the swift Cunarder "Lucania," which reached New York on Sept. 28, having made the run from Daunt's Rock to Sandy Hook lightship in 5 d., 7h., 48 min., thus beating the best previous record by herself on her last trip by 50 minutes. Her average speed was 21.76 knots for the voyage, and her best day's run was 552 knots. Her course was 2,782 miles in length. The vessel's best record for a 24 hours' run (made on a previous voyage) is 560 knots. She had favorable weather all the way across; but it is probable that record-breaking is about over for this season.

The amount of excavation completed on the Chicago Drainage Canal on Sept. 1 was about 13,000,000 cu. yds., of which over 1,300,000 cu. yds. was on the Des Plaines River division. Of this amount nearly 4,000,000 cu. yds. is classed as rock. The work done thus far has cost $5,600,000. Of this total $400,000 worth of work has been done in advance of the time required in the contract, but there is $1,600,000 of work behind, so there is a net deficiency in the rate of working of $1,200,000. It is estimated that the drainage board will have for disposal some 12,000,000 cu. yds. of excavated rock. Various propositions for the advantageous disposal of this material are under consideration, including its sale on a 10% commission and its use for macadamizing roads in Cook county.

Electricity is to be used for lighting the cable cars on the Brooklyn Bridge in place of the present oil lamps. At the last meeting of the Bridge trustees a report on this subject was handed in by Superintendent C. C. Martin, to whom the subject had been submitted. He reported that the Safety Car Heating & Lighting Co. had submitted the following bid: To equip 60 cars complete, with four 4-burner lamps each, or a total of 160 c. p. for each car, for $14,708 Including repairs, attendance and interest on equipment, said Mr. Martin, the cost of using Pintsch gas would be 7½ cts. per hour per car; if the bridge operated its own gas plant, it would cost 4.4 cts. per hour per car. The General Electric Co. proposed to equip 60 cars with ten 16-c. p. lamps each, together with engines, dynamos and complete plant, for $14,200, and to guarantee that the operating expenses should not exceed $4,905 per annum. Taking the interest on the first cost of the plant at 5%, or $710; depreciation and repairs at 6%, or $862, and adding these to the operating expenses, gives $6,478 for the total annual cost. This, says Mr. Martin, is equivalent to a cost of 5.3 cts. per hour per car. Another proposition from the Electrical & Mechanical Engineering & Trading Co. was to furnish complete equipment for lighting the cars with electric light, including engines, dynamos, wiring, etc., for the sum of $17,634. The total operating expense for the year would be $3,409.20. Including interest on investment at 5%, depreciation and repairs at 6%, the cost per car per hour for 160 c. p. of light would be 2.78 cts. Each of the bidders will give a satisfactory bond that the operating expenses of car lighting will not exceed the figure given by them respectively. The majority of the trustees voted to adopt electricity. It will require about three months to make the change.

Electricity has been applied to the spinning of rope and cordage by Mr. John Good, of Brooklyn, already well known as the man who revolutionized the manufacture of rope. Until Mr. Good took out his first patent in 1869 rope was made in the ropewalks, much after a fashion that had prevailed for centuries before. Since that time he has taken out about 50 patents for rope-making machines, and they are used all over the world. Mr. Good was born in Ireland in 1844, and was brought to the United States by his widowed mother in 1851. He was early thrown upon his own resources; began to invent and rented, but did not sell, his machines. As a result he is a power in the cordage world and very wealthy.

The dangerous grade crossing of the New York, New Haven & Hartford Railway, at Forest Hills, near Boston, Mass., is to be removed at an ultimate cost of about $3,000,000. The plans involve change of the course of Stony Brook near the station, and the cutting of a new channel about 1,400 ft. long. Another channel, 2,000 ft. long, will have to be cut from Boylston to Hogg bridge.

The armored cruiser "Maine" made a preliminary machinery trial on Sept. 25, and the working of the machinery was pronounced very satisfactory. Under a moderate forced draft the engines made 131 revolutions per minute with a steam pressure of 140 lbs. The estimated speed was 17 knots, on a 30-mile run out and back from Sandy Hook. The "Maine" is 318 ft. long, 57 ft. beam, 21½ ft. draft, 6,648 tons displacement and her contract horse-power is 9,000. The engines are of the twin-screw, vertical, triple-expansion type, and the contract speed is 17 knots. The "Maine" was built at the U. S. Navy Yard, at Brooklyn; work being authorized Aug. 3, 1886, and the cost limit was $2,500,000.

Plans for the elevation of the Chicago & Northwestern R. R. tracks between Sacramento Ave. and 40th St. in Chicago have been prepared by the company's officers and work will begin as soon as an enabling ordinance is passed by the city. The work is expected to occupy about 18 months. The tracks will be raised about 8 ft. above their present level and the streets will be depressed 8 ft. as a maximum.

The most serious railway accident of the week was the derailment of a freight train near Woodstock, Ill., on the Chicago & Northwestern Ry., Sept. 30, in which five persons were killed.—Another serious accident was a derailment, Sept. 30, near Maumee, O., on the Wabash R. R., in which the engineman and fireman were killed. A switch leading to a sidetrack had been opened by train wreckers, and the train was going too fast to take the turnout curve. The engine was upset and the men were crushed under it.—A third accident, fortunately unattended by loss of life, occurred at Lafayette, Ind., Sept. 27. Nineteen freight cars at the rear end of a freight train broke away on the heavy grade out from the city and ran back to the Union station, where a passenger train was standing. The yardmaster heard the cars coming and was in time to switch them onto a track at the east side of the station, where they ran over an earth bank used as a buffer stop, crossed the street and broke down the wall of a building. A number of the cars were smashed and piled up in the yard. The cars carried away part of the east side of the station, and a tank car entered the waiting room. A serious accident at the same place, caused by a passenger train running away while coming down the same grade, was reported in our issues of May 11 and 25, 1893.

The Illinois Central R. R. bridge over the Iowa River at Iowa Falls, Ia., was burned Sept. 28.

The outward bound oil tank steamer "Allegheny" was run into and sunk by the inward bound steamer "Caucase" in Delaware Bay, Oct. 1. Some of the tanks were burst by the collision and the oil caught fire, so that the rescue of the crew was accomplished with great difficulty.

The wrecked water tank at Salem, S. D. (see Eng. News, Aug. 9, 1894), has been rebuilt. The dimensions of the new tank are the same as those of the old, 16 × 24 ft. × 25 ft. high, and it is supported on the same style of tower except that the floor timbers are heavier. The present timbering consists of four 12 × 12-in. pieces, 6 ft. c. to c., with 3 × 12-in. pieces, 10 ins. c. to c., between, the whole thoroughly bridged and braced. The old tower failed because of the weakness of the floor timbers, which were 2 × 14-in. joists, 12 ins. c. to c., doubled beneath the center of the tank. We are indebted to Mr. M. A. Blackburn, of Salem, for the above information.

The 4,100-ft. cast iron intake pipe for the Cooperstown, N. Y., water-works has been completed by the contractor, Mr. Joseph G. Falcon, and work is now in progress taking up the old 10-in. cast iron intake pipe. The new pipe is of ⅝-in. cast iron, 14 ins. in diameter, and runs from a dam on the Susquehanna River, in that stream to the outlet of Otsego Lake, a distance of 2,700 ft., and thence 1,400 ft. out into the lake, where it ends in a cylindrical strainer placed about 5 ft. above the lake bottom. In the lake portion of the pipe 64 Falcon flexible ball joints were used, these being placed every five lengths and bolted by a diver at the lake bottom. The pipe was tested with 40 lbs. pressure; the gage fell almost imperceptibly to 20 lbs., where it remained until the test was completed. The depth of water in the lake at the outer end of the intake was 40 ft. The pipe was furnished by R. D. Wood & Co., of Philadelphia. Mr. J. Warren Lamb is Superintendent of the Cooperstown Water Co.

Fiber conduit for sewer work at Charleston, S. C., was called for in specifications for some recent work in that city. Mr. R. Frank Hartford, of Atlanta, Ga., who drew the specifications, informs us that the Charleston soil, especially in the outlying districts bordering on the salt marshes, causes rapid deterioration in cast iron pipe. Some experiments with pipe manufactured by the Fiber Conduit Co., of Orangeburgh, N. Y., promised so well that Mr. Hartford decided to put some of it to the test of actual use. Only a small amount of the pipe will be used, however, probably not over 40 ft., and that for an inverted siphon. Mr. Hartford thinks the pipe admirably adapted for sewer work where the pressure will not exceed 10 lbs. and neither steam nor water at high temperatures will reach it. The experimental tests were designed to determine the amount of absorption of the pipe and its acid-resisting qualities.

The proposed Lake Erie-Ohio River ship canal is being vigorously boomed by the Pittsburg Chamber of Commerce. A provisional committee has been appointed to take charge of the scheme and includes such men as C. L. Magee, ex-Governor A. B. Fleming, of West Virginia; H. C. Frick and B. F. Jones, the Pittsburg iron and steel manufacturers. Engineers and members of the committee have started over the three routes proposed to gather material upon which contractors may estimate the cost. The three routes are from Erie to Pittsburg, from Cleveland to Marietta and from Toledo to Cincinnati. Under the late river and harbor bill, the Secretary of War will also have a survey made by the army engineers, and will report to the next Congress.

The Canadian ship canal at Sault Ste. Marie was opened by admitting water into it on Sept. 24, and it is expected that it will be ready for navigation within a month. This canal, commenced May 1, 1889, is 3,700 ft. long and 21 ft. deep, and has one lift of 18¾ ft. The amount appropriated for the work was $4,000,000. It is similar in design to the United States ship canal now under construction on the American side of the river. The Canadian lock is 900 ft. long, from gate to gate, and 60 ft. wide. Around the gates the walls are 25 ft. thick, and the remaining walls are 20 ft. thick at the bottom and 11 ft. thick at the top. There will be 21 ft. of water over the miter sill. The filling and emptying are done through 152 openings in the lock floor leading to four culverts beneath the floor. At the eastern end are three sets of gates; one to be used for emptying the lock for repairs, etc., and another for use in case of accident. At the upper end of the lock are one main and a guard gate. These gates will be operated by electric power.

The designs for the Atlanta exposition buildings prepared by Mr. Bradford L. Gilbert, of New York city, have been accepted by the management, and he will be the architect of the Manufactures, Mining, Machinery, Electricity and Agricultural buildings. Mr. W. T. Downing, of Atlanta, will be the architect of the Administration building. The Manufactures building will be 216 × 370 ft., and the other buildings are in proportion. The exposition is to be held in the fall of 1895.

On Oct. 26 the people of the city of Duluth will vote on the purchase of the water plant of the Duluth Gas & Water Co., for $2,106,000, at which figure the company has offered to sell the plant. On the same date there will be a vote on issuing $600,000 in bonds to improve the present plant, if bought, and also on issuing bonds for an independent city plant.